

CONTRACT REPORT ARBRL-CR-00472

AUTOMATIC INPUT DATA GENERATION FOR
ADINA AND NASTRAN STRUCTURAL COMPUTER CODES

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) An existing structural finite element code SANX was modified to generate two new programs, ADIGEN and NASGEN. The SANX program is a three-dimensional code designed for approximate structural analysis of cylindrical configurations with deviations from axial symmetry. The input procedure for SANX is relatively simple and is similar to the procedure of two-dimensional axi-symmetric codes. The function of codes ADIGEN and NASGEN is to use the input data for SANX and internally generate input data for general three-dimensional codes ADINA and NASTRAN respectively. Numerical examples are given which illustrate the use of		

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the programs ADIGEN and NASGEN and the resulting saving of effort in developing data for ADINA and NASGEN.

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I. INTRODUCTION

The objective of the investigation was to utilize the SANX structural finite element computer program to generate the input data for ADINA and NASTRAN computer codes. The SANX program¹ is a structural finite element code which has been developed for the purpose of approximate three-dimensional analysis of non-axisymmetric configurations in cylindrical coordinates. The ADINA² and the NASTRAN³ codes are general finite element codes capable of handling structural analysis of multi-dimensional problems. However, the input procedure for these codes requires a great deal of time on the part of the user. On the other hand, the input procedure for the approximate three-dimensional program SANX is relatively simple since it is similar to the procedure for two-dimensional, axisymmetric codes such as SAAS.⁴ After the input data for SANX is created then the program itself generates a great deal of input information internally which contains almost all the information necessary for either ADINA or NASTRAN programs except this information is not in the correct form for these codes.

The result of the present investigation is a development of a modified version of SANX which does not perform stress analysis, but rather uses its own internal finite element information to generate the input data for ADINA or NASTRAN codes. Actually, two different versions of this program have been developed, one for ADINA and one for NASTRAN. Developing two different versions was dictated by the fact that the input procedures for ADINA and NASTRAN codes are of completely different form and, consequently, it is much more convenient to generate the input separately for each program.

1. Zak, A. R., Craddock, J. N. and Drysdale, W. H., "Approximate Finite-Element Method of Stress Analysis of Non-Axisymmetric Configurations," International Journal of Computers and Structures, Vol. 9, pp. 201-206, 1978.
2. Bathe, K. J., "ADINA-A Finite Element Program for Automatic Dynamic Incremental Nonlinear Analysis," MIT Acoustics and Vibration Laboratory, Mechanical Engineering Department, Report 82448-1, 1977, Cambridge, Massachusetts.
3. McCormick, C. W., "MSC/NASTRAN Basic Training Manual," MSR-46, 15 July 1977, (MacNeal-Schwendler Corporation, 7442 N. Figueroa Street, Los Angeles, CA 90041).
4. Sawyer, S. G., "BRLESC Finite Element Program for Axisymmetric, Plane Strain, and Plane Stress, Orthotropic Solids with Temperature-Dependent Material Properties," BRL Report No. 1539 (March 1971). AD #727702

II. MODIFIED VERSIONS OF SANX

Starting with the original SANX program, two modified versions, one for ADINA and one for NASTRAN, were developed. The two programs are called ADIGEN and NASGEN, and the flow charts for these codes are shown in Figures 1 and 2, respectively. It may be noted that the two flow charts are similar except ADIGEN contains the Subroutine ADINA and NASGEN has a Subroutine NASTRN in the same place.

The first step in generating these programs was to truncate the SANX code to remove the portion which does the stress analysis and retain the parts which generate nodal, element, and loading information. Referring to Figures 1 and 2, it can be seen that this includes all the subroutines in these flow charts except ADINA and NASTRN. The latter two are the only new subroutines in ADIGEN and NASGEN, respectively. After truncating the SANX code, the only changes which were made to the modified program, besides adding the extra subroutine to each version, were in the MAIN program. The remaining subroutines left from SANX have no changes. Descriptions of ADIGEN and NASGEN programs are given in the following sections.

III. PROGRAM ADIGEN

The program ADIGEN is designed to generate three-dimensional data for ADINA program. The listing for the ADIGEN program is given in Appendix A. In the MAIN portion of the program ADIGEN, there are two basic changes from SANX. The first change is the addition of six temporary files on which the generated data for ADINA is stored. The reason for six tapes is that SANX does not generate all the nodal data, element data, etc., sequentially, but rather various portions of this data are generated by looping through each segment of the structure. However, the ADINA input data has to have the data in the specific order. The procedure is, therefore, to store various components of data on separate files and then combine these in a Procedure File which also runs the program.

The six temporary files and their functions are as follows:

- TAPE2, ADNPD; nodal point data
- TAPE3, ADELD; element data
- TAPE4, ADMAX; material axes orientation
- TAPE7, ADNPX; extra nodal information necessary for
material axes orientation
- TAPE8, ADMPC; material property cards
- TAPE9, ADECC; element control card

The second basic change in the MAIN is the loading information of the temporary files ADMPC and ADECC. There are also some minor changes such as addition of common statement TOTAL and dimensional statement which contains two new quantities which are later set in the program.

The Subroutine ADINA is a new subroutine and essentially creates the remaining files ADNPD, ADELD, ADMAX, and ADNPX.

After the ADIGEN program is executed, then the above temporary files are assembled into one file called the ADI which represents the input data for ADINA program. The file ADI is obtained by assembling the temporary files in the following order:

ADNPD

ADNPX

ADECC

ADMPC

ADMAX

ADELD

The above order is dictated by the input requirements of the ADINA program. In order to illustrate how this procedure works the program ADIGEN was applied to a test example and the results will be presented and discussed later in this report.

IV. PROGRAM NASGEN

The program NASGEN is similar to ADIGEN in the sense that most of the changes are in the MAIN program and one new subroutine, NASTRN, has been added. The listing for the NASGEN is given in Appendix B. However, one big difference between ADIGEN and NASGEN is that the latter program contains only one additional file, TAPE1, NAS, as opposed to six for the ADIGEN. The file NAS contains the generated NASTRAN data. The reason why the NASTRAN data can be created with one file only, as opposed to six for ADINA, is that in the input procedure for NASTRAN, the data cards do not have to follow any specific order. As may be noted from the Subroutine NASTRN, each data card is started with a label which identifies the type of data on that card. The NASTRAN does its own sorting of cards.

Similarly to ADIGEN, the program NASGEN generates some of the data in the MAIN program and the rest in Subroutine NASTRN. In order to illustrate how the NASGEN program is used, a numerical test example will be given and discussed later in this report.

V. INPUT PROCEDURE FOR ADIGEN AND NASGEN PROGRAMS

The programs ADIGEN and NASGEN accept, directly, the input data for the elastic version of the SANX program. The procedure for developing the input data is described in Reference 1. In order to illustrate the procedure of using these programs, two numerical examples were executed and the corresponding input data for ADINA and NASTRAN was generated. The numerical examples are discussed below.

VI. NUMERICAL EXAMPLE - ADIGEN

The ADIGEN program was applied to a numerical example which corresponds to approximately 60° section of a non-axisymmetric cylinder. The actual configuration has no particular significance except that the data was available from previous investigations on the SANX program. The schematic of the physical configuration used in the numerical example is shown in Figure 3. The configuration is referred to a cylindrical coordinate system as required by the original SANX program.

For the purpose of the analysis the configuration is divided into four segments in the r - θ plane. This is illustrated in Figure 4. The first three segments are identical and the fourth is different. The first three segments are represented by segment Type No. 1 and the fourth by Type No. 2. The finite element models, in the r - z plane, for the two types of segments are illustrated in Figure 5 in the I-J grid configuration. The I-J grid is used in the SANX program and, therefore, in ADIGEN as the basis for numbering of the nodal points and the finite elements.

The above configuration was used in the ADIGEN program to generate the ADINA input file ADI. The listing for the ADI file is given in Appendix C. It is useful to identify various portions of this file which correspond to the various parts of the ADINA input data. In order to facilitate this discussion the start of each part of the data is identified in the right hand side by the original name of the temporary file as listed in the first part of this report.

Referring to Appendix C, the file ADI is divided into the following parts:

ADNPD Nodal Point Data

This data gives nodal point numbers and coordinates for the nodes which are later used to define finite elements. The coordinates are in the cylindrical coordinate system and, therefore, the letter X appears in front of each line. The scheme for generating numbers is as follows. Referring to Figure 4 it can be seen that the four segments

are separated by five planes. Each of these planes is in the r-z coordinate plane. The nodes in each of these planes are numbered starting from multiples of 200. For example, for the first plane the nodes start from 201, the second from 401, and the fifth from 1001. In any plane the nodes are numbered according to the I-J grid coordinate illustrated in Figure 3. The nodes are numbered in multiples of 25 depending on the value of J. For example, in the first plane, for J=1 the numbering starts from 201, for J=2 from 226, and so on. Using this scheme it is easy to identify the actual position of the node by its number relative to the r-z plane and the I-J grid.

ADNPX Extra Nodes for Defining Material Axes Orientation

For each finite element, which appears later in the ADI file, there are three extra nodes which define the material axes orientations. This is done by using number 7000, 8000, and 9000 and adding to them the element number. For example, for element 201 the three nodes are 7201, 8201, and 9201.

ADECC Element Control Card

This card is self explanatory according to the ADINA User's Manual.

ADMPC Material Property Cards

There are three materials used in the example and for each of these there are two material property cards as required by ADINA.

ADMAX Material Axes Orientation

For each element one card is generated which contains an element ID number, later repeated in the element data card, and the three nodes defining the material orientation according to the scheme required by ADINA.

ADELD Element Data

For each element there are two cards generated. The first card defines the material information, according to ID number from ADMAX data, and the second card contains eight nodal points for the three-dimensional finite element. It may be noted that the elements are numbered sequentially. This is done by starting with segment No. 1 and using the scheme from SANX in which the elements are numbered first in the I direction followed by variation in the J direction.

VII. NUMERICAL EXAMPLE - NASGEN

The NASGEN program has been applied to a numerical example which corresponds to a 90° section of a non-axisymmetric cylinder. The geometry of the cylinder used in this numerical example is shown in Figure 6. The configuration is referred to a (r, z, θ) cylindrical coordinate system.

For analysis purposes the configuration was divided into five segments in the $r-\theta$ plane. The division into the segments is shown in Figure 7. The first and fifth segments are identical, the second, third, and fourth are different but identical. The first and fifth segments are represented by segment Type No. 1, whereas the second, third, and fourth segments are represented as Type No. 2. The finite element models in the $r-z$ plane for the two different types of segments are illustrated in Figure 8 in the I-J grid configuration. The loading on the cylinder is assumed to be composed of an axial and radial pressure of 30×10^3 psi which is illustrated as acting on the different segments shown in Figure 8. The axial pressure is assumed to cause axial acceleration which has been calculated to match the external pressure load assuming aluminum material.

The NAS data generated for this example is shown in Appendix D. It is useful to identify the various types of data in this file by referring to Appendix D. The NAS data file contains the following generated input cards for the NASTRAN program:

GRID cards;

These cards define the cylindrical coordinates for the grid points. The scheme used to number the grids is as follows. Referring to Figure 7 it can be observed that the five segments are separated by six planes in the $r-z$ plane. The grid points in each of these planes are numbered starting from multiples of 2000. For example, starting with the plane to the left of Segment No. 1, the first grid point will be 2001. Taking these planes in geometrical order, the first grid point in the plane between Segment No. 1 and No. 2 will be 4001, and so on. In addition to this scheme, in each plane the grid points are also numbered in the multiples of 25 depending on the value of J. For example, in the first plane, for $J=1$ the numbering starts with 2001, for $J=2$ the first grid is 2026, and so on. Using this scheme it is easy to identify the position of each grid point.

CHEXA cards;

These cards define the three-dimensional, isoparametric, finite elements. Each CHEXA has a continuation card identified by the NASTRAN procedure. Each pair of cards identifies the element number, material, and the eight connecting

grid points. The scheme of numbering the elements is according to the segment number. Starting with Segment No. 1 of Figure 7, the first element is numbered 2001, in the Segment No. 2 with 4001, and so on with multiples of 2000. In the segment the elements are numbered sequentially.

PLOAD cards;

These cards define the pressure load cards relative to four grid points.

MAT1 card;

This card defines the material properties.

CORD1C card;

This card, together with three additional GRID cards numbered 101, 102, and 103, defines the cylindrical coordinate orientation relative to the basic, Cartesian coordinate system.

GRAV card;

This defines the axial acceleration load.

PSOLID card;

This card controls the output parameters for the CHEXA elements.

VIII. CONCLUDING REMARKS

This report describes two programs, ADIGEN and NASGEN, which are designed for automatic generation of input data for the general purpose finite element structural codes ADINA and NASTRAN respectively. The two programs, ADIGEN and NASGEN, have been developed by modifying SANX structural program which was previously developed at the University of Illinois. Using these two programs, numerical examples were executed. The result of these examples is input data for ADINA and NASTRAN programs. The data for the NASTRAN program was checked-out by executing the NASTRAN program. Similar check was not performed for the ADINA program since this program is not available at the University of Illinois. In conclusion, it may be observed that the two new programs, ADIGEN and NASGEN, generate a great deal of input data for the ADINA and NASTRAN codes. In each case this data was generated from approximately 20 to 30 input cards required by the SANX code. Consequently, the automatic input data generation has a great potential of reducing the necessary effort in using the ADINA and NASTRAN programs.

REFERENCES

1. Zak, A.R., Craddock, J.N. and Drysdale, W.H., "Approximate Finite-Element Method of Stress Analysis of Non-Axisymmetric Configurations," International Journal of Computers and Structures, Vol. 9, pp. 201-206, 1978.
2. Bathe, K.J., "ADINA-A Finite Element Program for Automatic Dynamic Incremental Nonlinear Analysis," MIT Acoustics and Vibration Laboratory, Mechanical Engineering Department, Report 82448-1, 1977, Cambridge, Massachusetts.
3. McCormick, C.W., "MSC/NASTRAN Basic Training Manual," MSR-46, 15 July 1977, (MacNeal-Schwendler Corporation, 7442 N. Figueroa Street, Los Angeles, CA 90041.)
4. Sawyer, S.G., "BRLESC Finite Element Program for Axisymmetric, Plane Strain, and Plane Stress, Orthotropic Solids with Temperature-Dependent Material Properties," BRL Report No. 1539 (March 1971). AD #727702

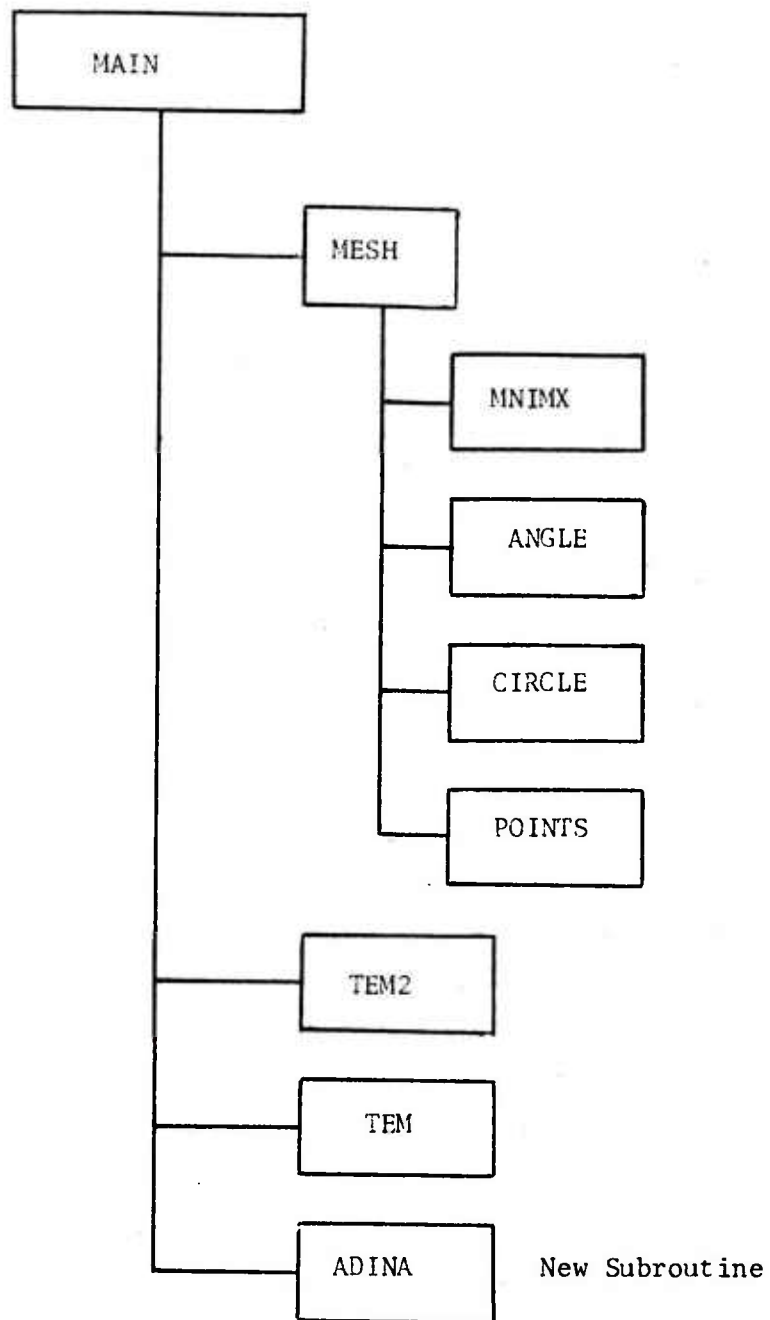


Figure 1. Flow Chart for ADIGEN Computer Program

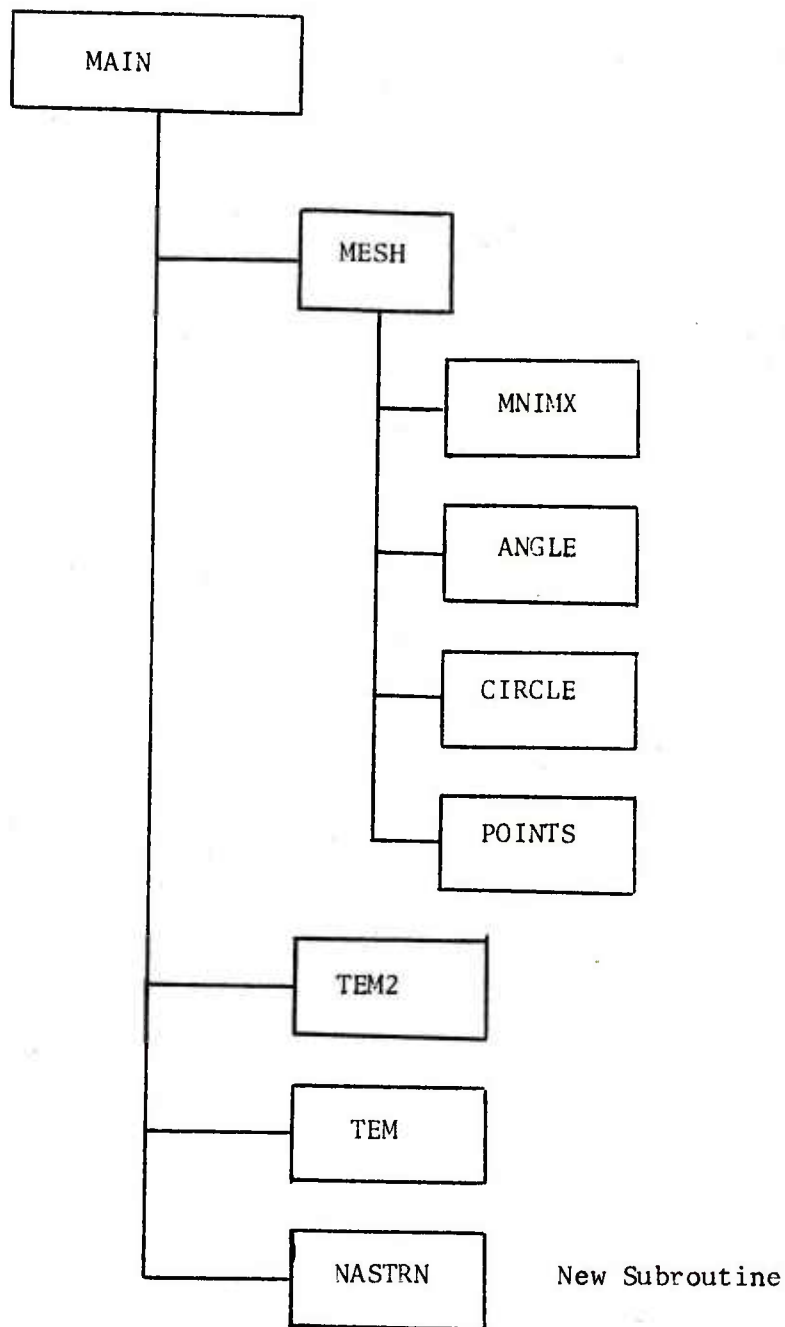


Figure 2. Flow Chart for NASGEN Computer Program

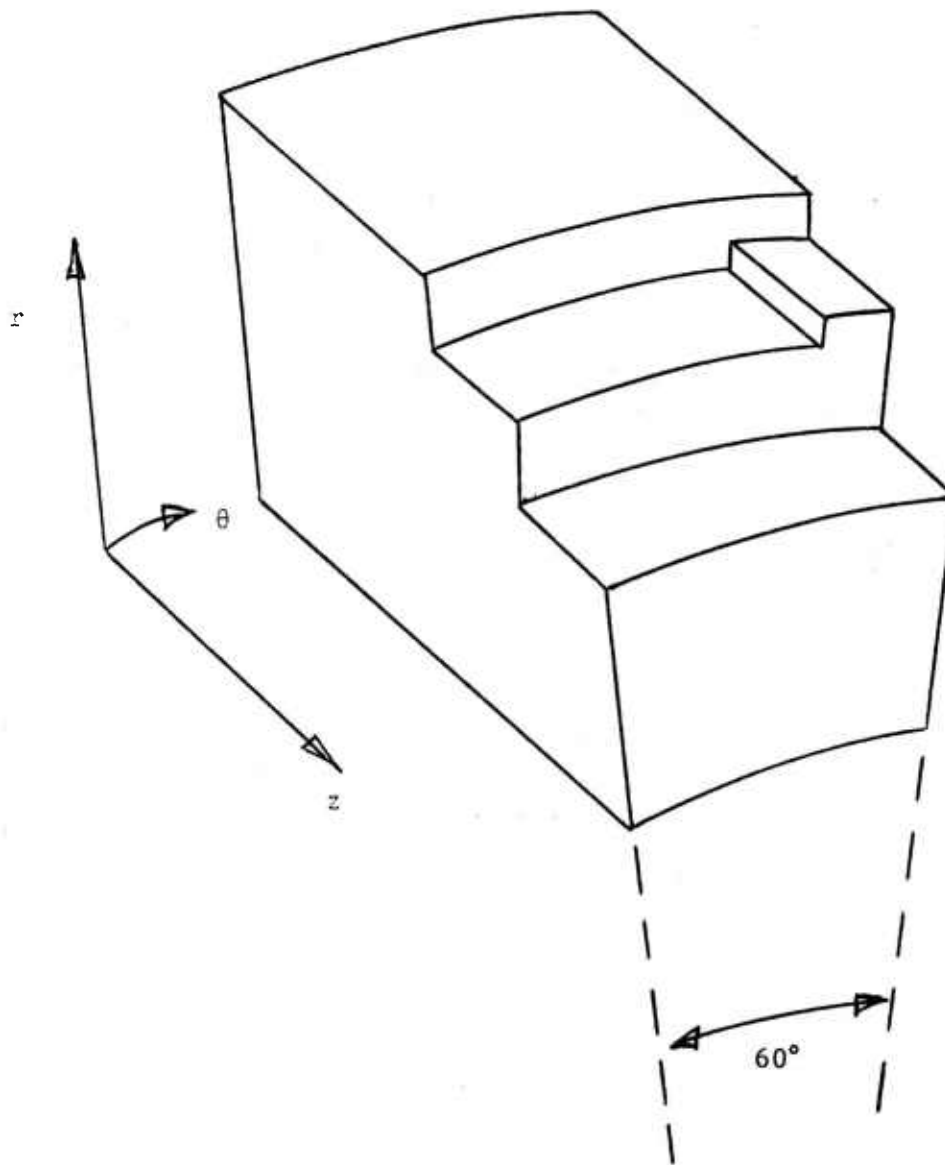


Figure 3. Cylindrical Configuration Used in the Numerical Example

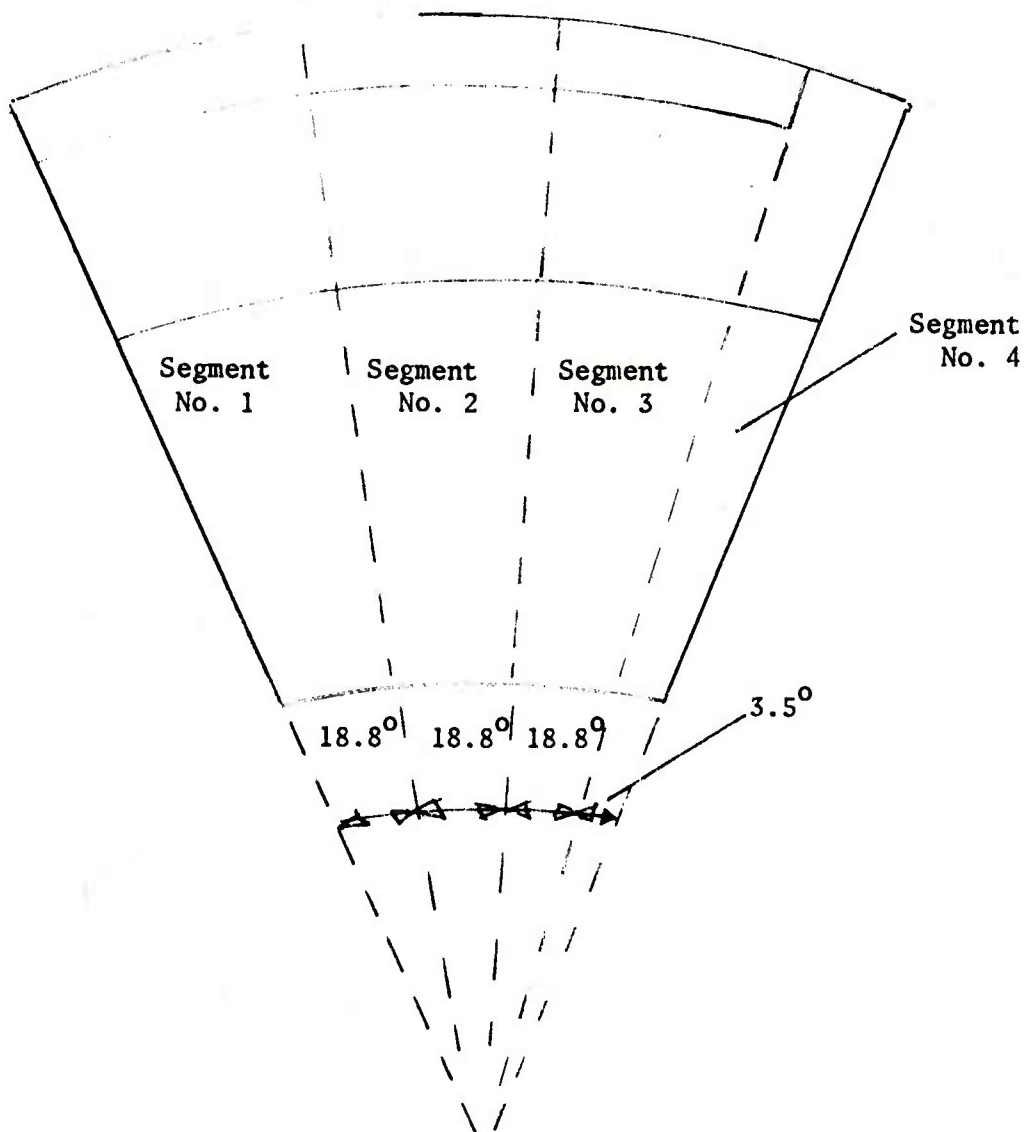


Figure 4. Division of Cylindrical Configuration into Four Segments

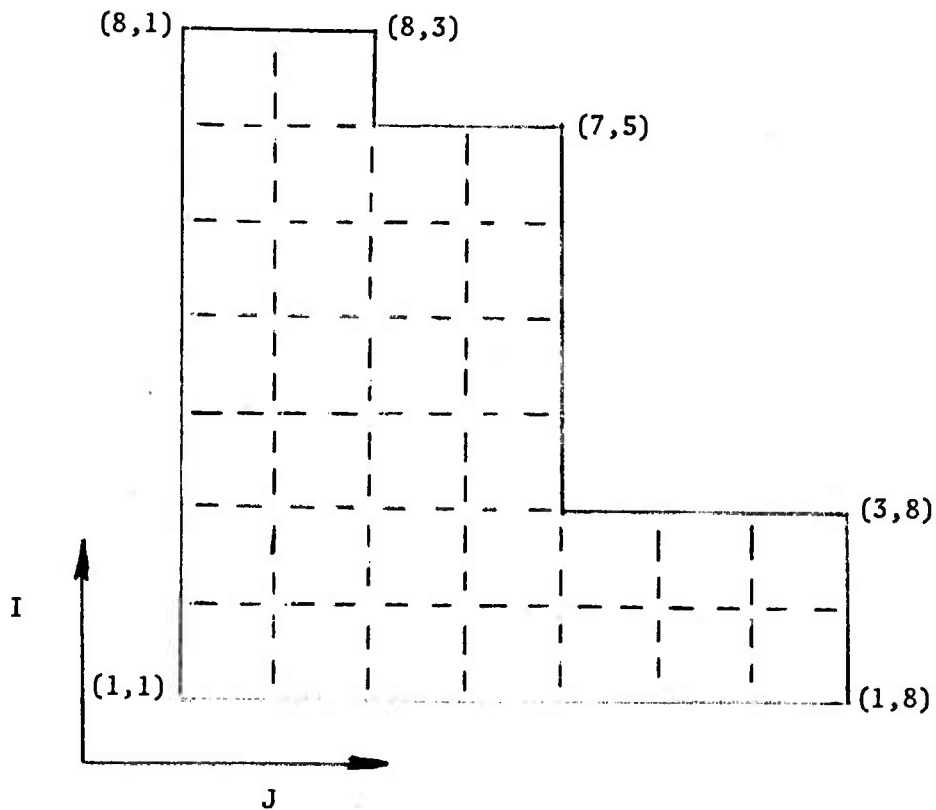
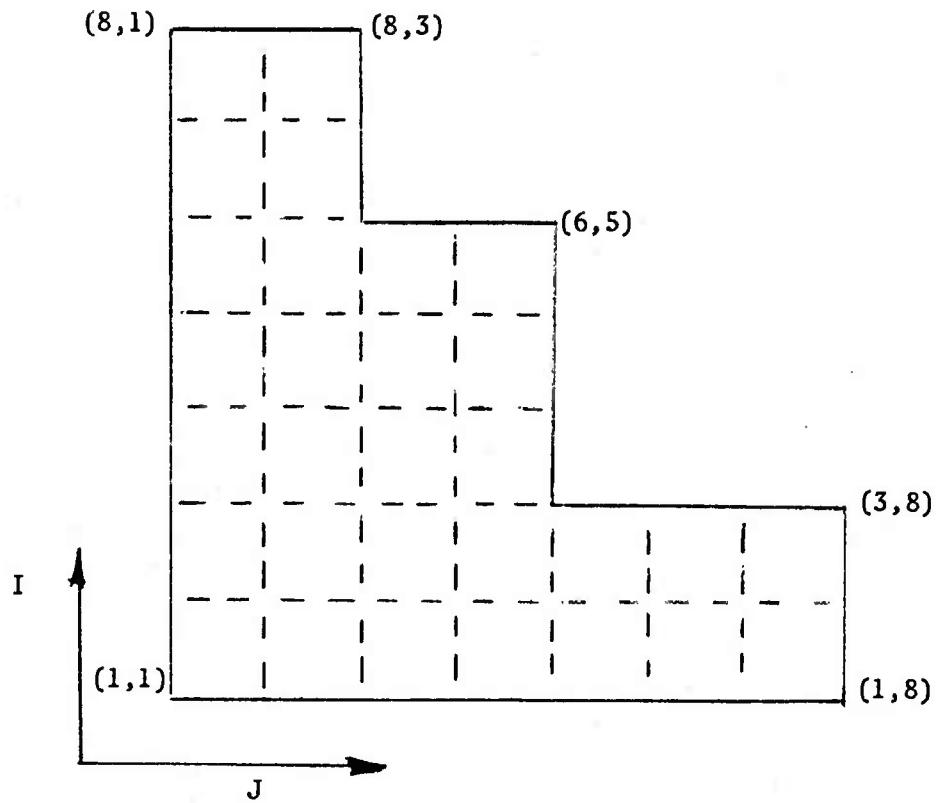


Figure 5. The I-J Grid Used in the Finite Element Model for Segment Types No. 1 and No. 2

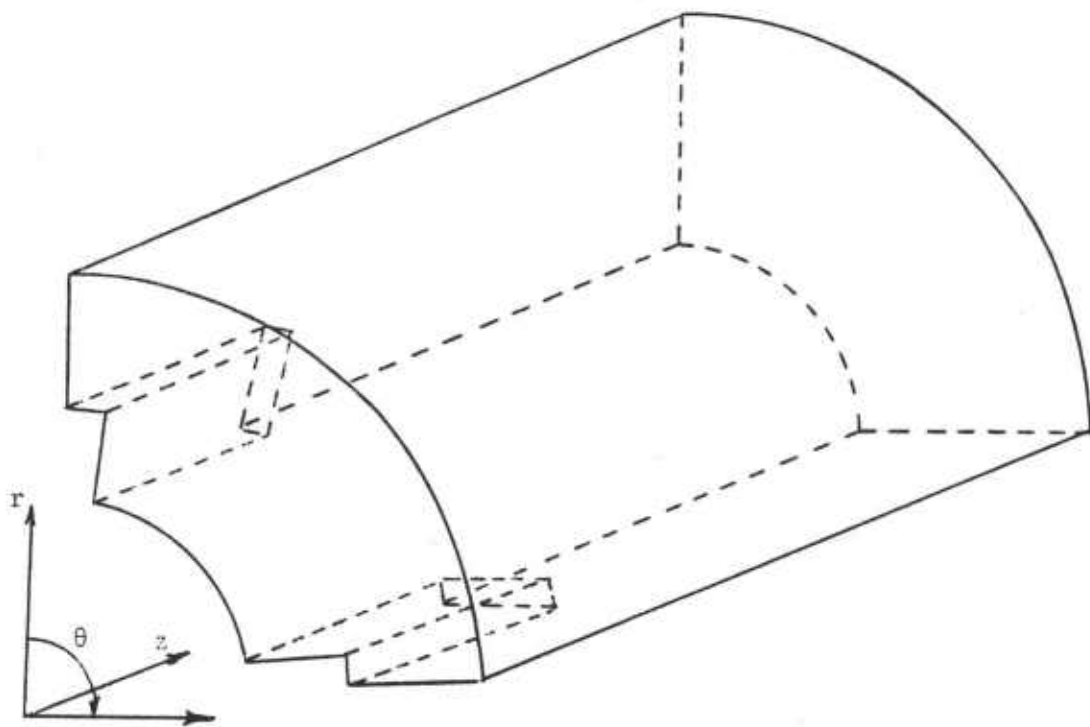


Figure 6. Nonaxisymmetric Cylindrical Configuration
Used in the Numerical Example

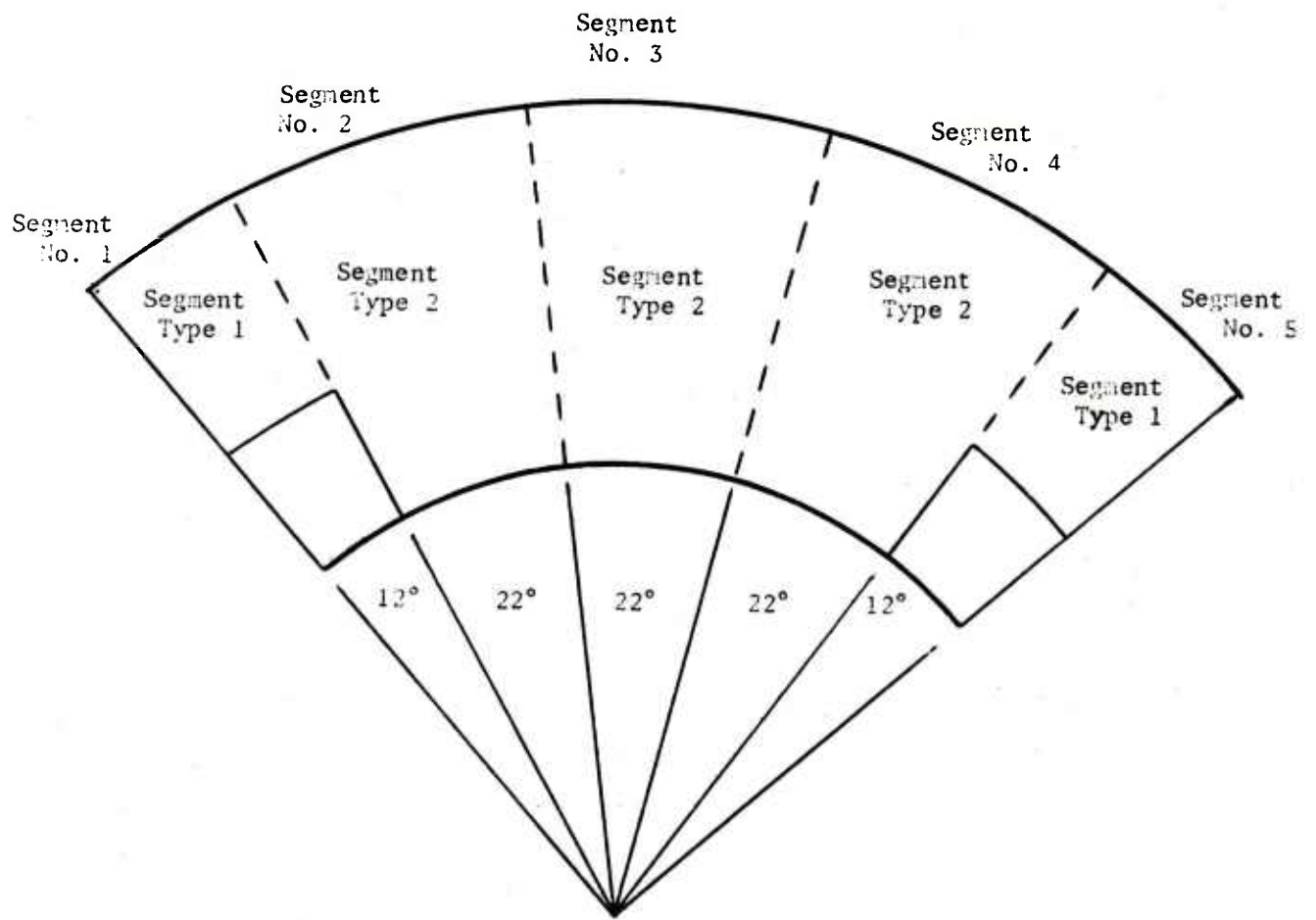


Figure 7. Division of Cylindrical Configuration Into Five Segments

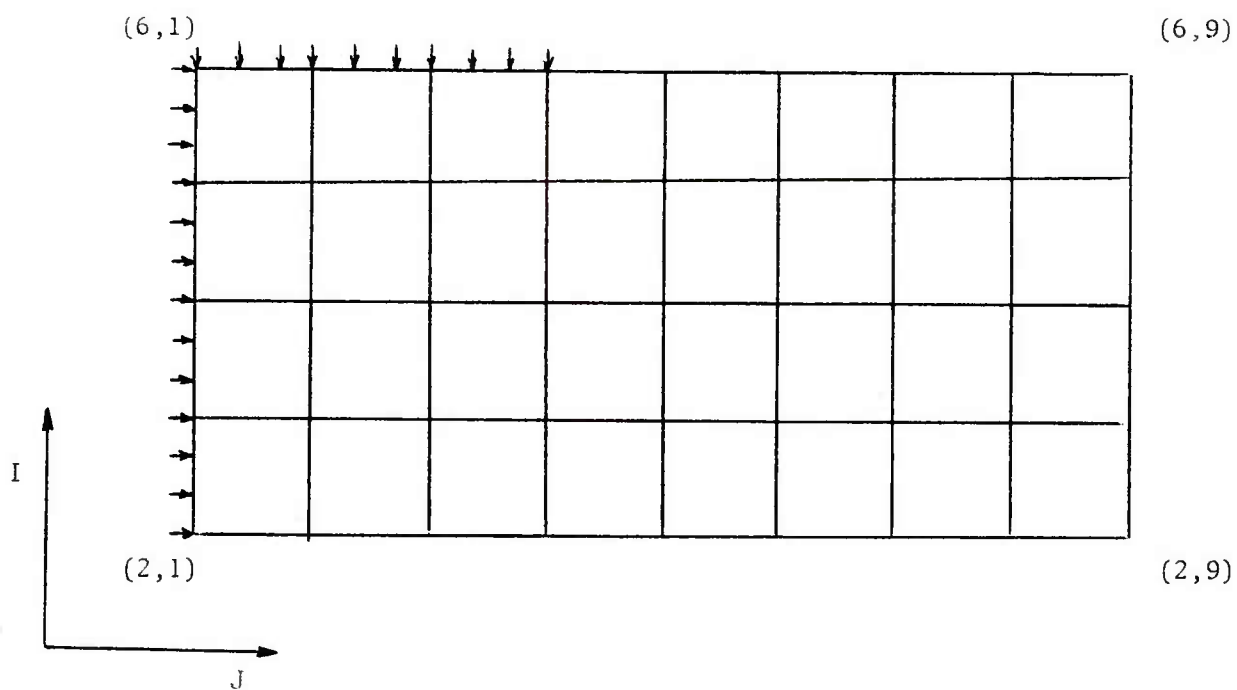
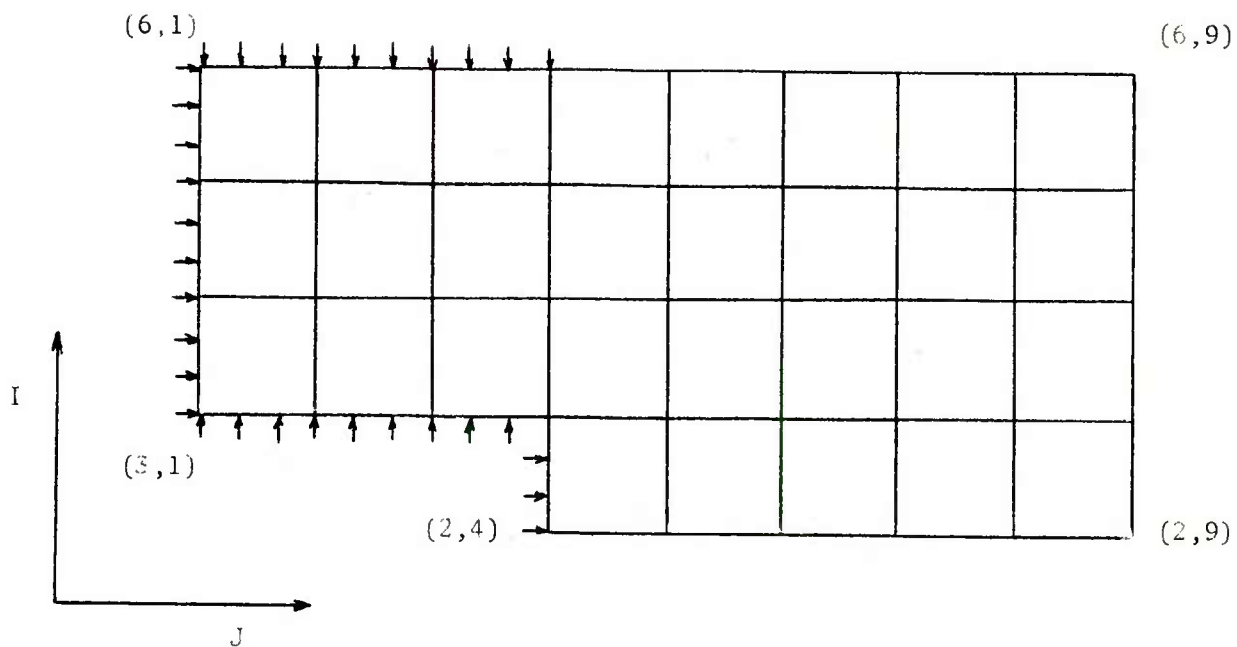


Figure 8. The I-J Grid for the Segment Types 1 and 2 and the External Pressure Load

APPENDIX A

Listing of the ADIGEN Program

```

PROGRAM ADIGEN(INPUT,OUTPUT,ADNPD,ADNPX,ADECC,ADMPC,ADMAX,ADELD
1,ADPRL,TAPE5=INPUT,TAPE6=OUTPUT,TAPE2=ADNPD,TAPE7=ADNPX,TAPE9=
2 ADECC,TAPE8=ADMPC,TAPE4=ADMAX,TAPE3=ADELD,TAPE1=ADPRL)
INTEGER CODE
COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
1NPNUM(25,80),T(1000),XT(1000)
COMMON/ARG/RRR(5),ZZZ(5),RR(4),ZZ(4),S(15,15),P(15),TT(6),
1H(6,15),CRZ(6,6),XI(10),ANGLE(4),SIG(18),EPS(18),N
COMMON/ELDATA/BETA(1000),EPR(1000),PR(200),SH(200),IX(1000,5),
1IP(200),JP(200),IS(200),JS(200),ALPHA(1000),IT(200),JT(200),
2ST(200),INP(1000),JNP(1000)
COMMON/BASIC/ACELZ,ANGVEL,ANGACC,TREF,VOL,NUMNP,NUMEL,NUMPC,NUMSC,
1NUMST
COMMON/NXMESH/THETAN(4),NST(4),NUMS(4,5),NPC(8,8)
COMMON/ANSL/NUMELS(4),NUMNPS(4)
COMMON/NXDATA/NTP,NTYPS,NTS,NTOTS
COMMON/NONAXI/S1(30,30),P1(30),THETA,BS1(6,30)
COMMON/SOLVE/X(4428),Y(4428),TEM(4428),NUMTC,MBAND
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
COMMON/CONVRG/IDONE
COMMON/PLANE/NPP
COMMON/RESULT/BS(6,15),D(6,6),C(6,6),AR,BB(6,9),CNS(6,6)
COMMON/MATP/RO(6),E(12,16,6),EE(16),AOFTS(6)
COMMON/TOTAL/NENL
DIMENSION TITLE(20),FTHETA(8)
C*****
C
C   WRITE ADINA DATA BLOCK HEADINGS
C
C*****
WRITE(1,5001)
WRITE(2,5002)
WRITE(3,5003)
WRITE(4,5004)
WRITE(7,5007)
WRITE(8,5008)
WRITE(9,5009)
5001 FORMAT("***** 3/D PRESSURE LOAD DATA *****")
5002 FORMAT("***** NODAL POINT DATA *****")
5003 FORMAT("***** 3/D ELEMENT DATA *****")
5004 FORMAT("***** MATERIAL AXES ORIENTATION *****")
5007 FORMAT("***** EXTRA NODES FOR MATERIAL AXES *****")
5008 FORMAT("***** MATERIAL PROPERTY CARDS *****")
5009 FORMAT("***** ELEMENT COTROL CARD *****")
C* * * * *
C   READ AND WRITE CONTROL INFORMATION
C* * * * *
READ(5,3000) NTYPS,NTOTS
DO 150 I=1,NTYPS
150 READ(5,3001) THETAN(I),NST(I)
DO 151 I=1,NTYPS
J2 =NST(I)

```

```

151 READ(5,3000) (NUMS(I,J),J=1,J2)
DO 152 I=1,NTOTS
152 READ(5,3002) (NPC(I,J),J=1,8)
3000 FORMAT(8I10)
3001 FORMAT(F10.5,I10)
3002 FORMAT(8I10)
NFACE=NTOTS+1
FTHETA(1)=0.0
DO 4100 I=1,NTOTS
DO 4000 J=1,NTYPS
K2=NST(J)
DO 4000 K=1,K2
4000 IF(NUMS(J,K).EQ.I) GO TO 4100
4100 FTHETA(I+1)=FTHETA(I)+THETAN(J)
WRITE(6,4200) ((FTHETA(I),I),I=1,NTOTS)
4200 FORMAT("1"," ANGLE IN DEGREES ",5X," BEGINNING SEGMENT #"/
1 (E20.10,I10))
WRITE(6,3010)
3010 FORMAT("1","SEGMENT DATA FOR NONAXISYMMETRIC PROBLEM")
WRITE(6,3011) NTYPS,NTOTS
3011 FORMAT (" ", " NUMBER OF TYPES OF SEGMENTS = ",I5,/,
1 " NUMBER OF TOTAL SEGMENTS =",I5)
DO 153 I=1,NTYPS
WRITE(6,3012) I,THETAN(I),NST(I)
3012 FORMAT(" ",///," SEGMENT TYPE = ",I5/, " THETA = ",F10.5/,
1 " NUMBER OF SEGMENTS OF THIS TYPE = ",I5)
J2 = NST(I)
WRITE(6,3013) (NUMS(I,J),J=1,J2)
3013 FORMAT(" ", " SEGMENT NUMBERS IN GLOBAL SYSTEM ARE ",5I5)
153 CONTINUE
DO 154 I=1,NTOTS
154 WRITE(6,3014) I, (NPC(I,J),J=1,8)
3014 FORMAT(" ", "CONNECTING NODES FOR SEGMENT",I5," ARE",8I5)
NENL=0
DO 950 NTP = 1,NTYPS
THETA= THETAN(NTP) /57.295780
50 READ(5,1000) TITLE,NNLA,NUMTC,NUMMAT,NUMPC,NUMSC,NUMST,TREF
1,INERT,NLINC,INCI,INCF,IPLOT
WRITE(6,2000) TITLE,NNLA,NUMTC,NUMMAT,NUMPC,NUMSC,NUMST,TREF,INERT,
1NLINC
NPP=0
C* * * * *
C GENERATE FINITE ELEMENT MESH
C* * * * *
100 CALL MESH
NUMELS(NTP) = NUMEL
NUMNPS(NTP) = NUMNP
C* * * * *
C READ AND WRITE TEMPERATURE DATA
C* * * * *
103 IF(NUMTC.EQ.0) GO TO 440
IF(NUMTC.GT.0) READ(5,1001) (X(I),Y(I),TEM(I),I=1,NUMTC)

```

```

      IF(NUMTC.EQ.-2) CALL TEM2(NUMNP)
      IF(NUMTC.EQ.-2) GO TO 440
      MPRINT=0
      DO 210 I=1,NUMTC
      IF(MPRINT.NE.0) GO TO 200
      WRITE(6,2001)
      MPRINT=59
200  MPRINT=MPRINT-1
210  WRITE(6,2002) X(I),Y(I),TEM(I)
      MPRINT=0
      DO 230 N=1,NUMNP
      IF(MPRINT.NE.0) GO TO 220
      WRITE(6,2003)
      MPRINT=59
220  MPRINT=MPRINT-1
      CALL TEMP(R(N),Z(N),T(N))
230  WRITE(6,2004) N,R(N),Z(N),T(N)
440  MPRINT=0
      DO 460 N=1,NUMEL
      IF(MPRINT.NE.0) GO TO 450
      WRITE(6,2008)
      MPRINT=59
450  MPRINT=MPRINT-1
      II=IX(N,1)
      JJ=IX(N,2)
      KK=IX(N,3)
      LL=IX(N,4)
C
C      TEM IS TEMPORARY STORAGE FOR ELEMENT TEMPERATURES
C
      TEM(N)=(T(II)+T(JJ)+T(KK)+T(LL))/4.00
460  WRITE(6,2009) N,(IX(N,I),I=1,5),BETA(N),ALPHA(N),TEM(N)
      DO 470 K=1,NUMEL
470  T(K)=TEM(K)
C* * * * *
C      READ AND WRITE MATERIAL PROPERTIES
C* * * * *
500  CONTINUE
      DO 510 M=1,NUMMAT
      READ(5,1004) MTYPE,(NT,RO(MTYPE),AOFTS(MTYPE))
      WRITE(6,2010) MTYPE,NT,RO(MTYPE)
      READ(5,1005)((E(I,J,MTYPE),J=1,14),I=1,NT)
      IF(AOFTS(MTYPE).NE.1.) WRITE(6,2011)((E(I,J,MTYPE),J=1,13),I=1,NT)
      IF(AOFTS(MTYPE).EQ.1.) WRITE(6,2012)((E(I,J,MTYPE),J=1,13),I=1,NT)
      DO 510 I=NT,12
      DO 510 J=1,16
510  E(I,J,MTYPE)=E(NT,J,MTYPE)
      DO 900 NL=1,NLINC
      WRITE(6,2030) NL
      ACELZ=0.00
      ANGVEL=0.00
      ANGACC=0.00

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      IF(INERT .EQ. 0) GO TO 511
      IF(NL .NE. 1 .AND. INCI .EQ. 0) GO TO 511
C*****
C      READ AND WRITE DYNAMIC FORCES
C*****
      READ(5,1030) ACELZ, ANGVEL, ANGACC
      WRITE(6,2031) ACELZ, ANGVEL, ANGACC
511 CONTINUE
C* * * * *
C      READ AND WRITE PRESSURE AND SHEAR BOUNDARY CONDITIONS
C* * * * *
      IF(NL .NE. 1 .AND. INCF .EQ. 0) GO TO 700
600 IF(NUMPC.EQ.0) GO TO 630
      MPRINT=0
      DO 620 L=1,NUMPC
      IF(MPRINT.NE.0) GO TO 610
      WRITE(6,2013)
      MPRINT=58
610 MPRINT=MPRINT-1
      READ(5,1006) IP(L),JP(L),PR(L)
620 WRITE(6,2014) IP(L),JP(L),PR(L)
630 IF(NUMSC.EQ.0) GO TO 701
      MPRINT=0
      DO 650 L=1,NUMSC
      IF(MPRINT.NE.0) GO TO 640
      WRITE(6,2015)
      MPRINT=58
640 MPRINT=MPRINT-1
      READ(5,1006) IS(L),JS(L),SH(L)
650 WRITE(6,2014) IS(L),JS(L),SH(L)
701 IF(NUMST.EQ.0) GO TO 700
      MPRINT=0
      DO 680 L=1,NUMST
      IF(MPRINT.NE.0) GO TO 670
      WRITE(6,2025)
      MPRINT=58
670 MPRINT=MPRINT-1
      READ(5,1006) IT(L),JT(L),ST(L)
680 WRITE(6,2014) IT(L),JT(L),ST(L)
C* * * * *
C      DETERMINE BANDWIDTH, INITIALIZE ELASTIC-PLASTIC RATIO,
C      AND CONVERT BETA FROM DEGREES TO RADIANS
C* * * * *
700 J=0
      DO 710 N=1,NUMEL
      IX(N,5)=IABS(IX(N,5))
      DO 710 I=1,4
      DO 710 L=1,4
      KK=IABS(IX(N,I)-IX(N,L))
      IF(KK.GE.J) J=KK
710 CONTINUE
      MBAND=3*J+3

```

```

      IF(NL.GT.1) GO TO 721
      DO 720 N=1,NUMEL
      EPR(N)=1.
      ALPHA(N)=ALPHA(N)/57.295780
720  BETA(N)=BETA(N)/57.295780
721  CONTINUE
900  CONTINUE
      CALL ADINA(NFACE,FTHETA)
950  CONTINUE
C
C      WRITE ELEMENT CONTROL ON FILE 9
      NZ=0
C
      WRITE(9,4400) NENL,NZ,NZ,NZ,NUMMAT,NZ,NENL,NZ
4400  FORMAT(3X,"3",3I4,11X,"8",20X,I4,7X,"2",3I4,4X,I4)
C
C      WRITE MATERIAL PROPERTIES ON FILE 8
C
      DO 960 I=1,NUMMAT
      WRITE(8,4500) I,RO(I)
4500  FORMAT(I5,F10.5)
      WRITE(8,4600) (E(1,J,I),J=2,5),E(1,7,I),E(1,6,I),
      1E(1,8,I),E(1,10,I)
      WRITE(8,4600) E(1,9,I)
960  CONTINUE
4600  FORMAT(3F10.0,3F10.3,2F10.0)
910  CONTINUE
1000  FORMAT(20A4/6I5,F5.0,5I5)
1001  FORMAT(3F10.0)
1004  FORMAT (2I5,2F10.0)
1005  FORMAT(7F10.0)
1006  FORMAT (2I5,F10.0)
1030  FORMAT(3F10.0)
2000  FORMAT (2H1 ,20A4/
1  33H0  NUMBER OF APPROXIMATIONS-----I4/
2  33H0  NUMBER OF TEMPERATURE CARDS---I4/
3  33H0  NUMBER OF MATERIALS-----I4/
4  33H0  NUMBER OF PRESSURE CARDS-----I4/
5  33H0  NUMBER OF SHEAR CARDS-----I4/
6  33H0  NUMBER OF TORSION CARDS-----I4/
7  33H0  REFERENCE TEMPERATURE-----E12.4/
8  33H0  NUMBER OF INERTIA CARDS-----I4/
9  33H0  NUMBER OF LOAD INCREMENTS-----I4/)
2001  FORMAT (1H1,13X,1HR,14X,1HZ,14X,1HT)
2002  FORMAT (3F15.3)
2003  FORMAT (35H1      N          R          Z          T)
2004  FORMAT (I5,2F10.4,F10.0)
2008  FORMAT (74H1  EL   I   J   K   L      MATERIAL      ANGLE BETA      ANGLE A
      1LPHA      TEMPERATURE)
2009  FORMAT (I5,4I4,I8,F11.1,2F13.3)
2010  FORMAT (1H1,"MATERIAL IDENTIFICATION NUMBER =",I2/
      11H , "NO. OF MATERIAL TEMPERATURE CARDS =",I2/

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21H , "MASS DENSITY =",E15.7)
2011 FORMAT (1H , "TEMPERATURE =",E15.7/
11H , "MODULUS OF ELASTICITY-EN =",E15.7/
21H , "MODULUS OF ELASTICITY-ES =",E15.7/
31H , "MODULUS OF ELASTICITY-ET =",E15.7/
41H , "POISSON RATIO-NUNS =",E15.7/
51H , "POISSON RATIO-NUNT =",E15.7/
61H , "POISSON RATIO-NUST =",E15.7/
71H , "SHEAR MODULUS-GNS =",E15.7/
81H , "SHEAR MODULUS-GST =",E15.7/
91H , "SHEAR MODULUS-GTN =",E15.7/
11H , "COEFFICIENT OF THERMAL EXPANSION-AN =",E15.7/
21H , "COEFFICIENT OF THERMAL EXPANSION-AS =",E15.7/
31H , "COEFFICIENT OF THERMAL EXPANSION-AT =",E15.7/)
2012 FORMAT (1H , "TEMPERATURE =",E15.7/
11H , "MODULUS OF ELASTICITY-EN =",E15.7/
21H , "MODULUS OF ELASTICITY-ES =",E15.7/
31H , "MODULUS OF ELASTICITY-ET =",E15.7/
41H , "POISSON RATIO-NUNS =",E15.7/
51H , "POISSON RATIO-NUNT =",E15.7/
61H , "POISSON RATIO-NUST =",E15.7/
71H , "SHEAR MODULUS-GNS =",E15.7/
81H , "SHEAR MODULUS-GST =",E15.7/
91H , "SHEAR MODULUS-GTN =",E15.7/
11H , "FREE THERMAL STRAIN-FN =",E15.7/
21H , "FREE THERMAL STRAIN-FS =",E15.7/
31H , "FREE THERMAL STRAIN-FT =",E15.7/)
2013 FORMAT (30H1 PRESSURE BOUNDARY CONDITIONS/20H      I      J  PRESSURE)
2014 FORMAT (215,F10.1)
2015 FORMAT (27H1 SHEAR BOUNDARY CONDITIONS/17H      I      J  SHEAR)
2016 FORMAT (26H  THE SYSTEM CONVERGED IN I2,11H ITERATIONS)
2017 FORMAT (33H  THE SYSTEM DID NOT CONVERGE IN I2,11H ITERATIONS)
2024 FORMAT (43H0 THE AXISYMMETRIC OPTION NAS BEEN SELECTED)
2025 FORMAT(30H1 TORSION BOUNDARY CONDITIONS/17H      I      J  SHEAR)
2030 FORMAT(1H1,"LOAD STEP=",I4)
2031 FORMAT(1H0 , "AXIAL ACCELERATION  =",E12.4/
11H0 , "ANGULAR VELOCITY      =",E12.4/
21H0 , "ANGULAR ACCELERATION=",E12.4)
920 STOP
END
SUBROUTINE ANGLE (R,Z,RC,ZC,ANG)
C  FIND ANGLE OF INCLINATION BETWEEN 0 AND 2*PI
C* * * * *
PI=3.1415927
D1=(Z-ZC)
D2=(R-RC)
IF(ABS(R-RC).GT.1.E-8) GO TO 100
ANG=PI/2.
IF(D1.GT.1.E-8) RETURN
ANG=-ANG
RETURN
C* * * * *

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```

C      ALLOW CIRCLE TO CROSS AXIS
C* * * * *
100  ANG=ATAN2(D1,D2)
      RETURN
      END
      SUBROUTINE CIRCLE(ANG1,DELPHI,RSTRT,ZSTRT,RC,ZC,I,J)
      INTEGER CODE
      COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
      COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
      INPNUM(25,80),T(1000),XT(1000)
      DIMENSION AR(25,80),AZ(25,80)
      EQUIVALENCE (R(1),AR),(Z(1),AZ)
C* * * * *
C      FIND INTERSECTION OF LINE AND CIRCLE = NEW R AND Z
C* * * * *
      ANG1=ANG1+DELPHI
      RR=SQRT((RSTRT-RC)**2+(ZSTRT-ZC)**2)
      AR(I,J)=RC+RR*COS(ANG1)
      AZ(I,J)=ZC+RR*SIN(ANG1)
      RETURN
      END
      SUBROUTINE MESH
      INTEGER CODE
      DIMENSION AR(25,80),AZ(25,80),NCODE(25,80)
      COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
      COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
      INPNUM(25,80),T(1000),XT(1000)
      COMMON/ELDATA/BETA(1000),EPR(1000),PR(200),SH(200),IX(1000,5),
      LIP(200),JP(200),IS(200),JS(200),ALPHA(1000),IT(200),JT(200),
      2ST(200),INP(1000),JNP(1000)
      EQUIVALENCE (R(1),AR),(Z(1),AZ),(IX(1,1),NCODE)
C* * * * *
C      MESH CONTROL INFORMATION
C* * * * *
      READ (5,1000) MAXI,MAXJ,NSEG,NBC,NMTL
      WRITE(6,2000) MAXI,MAXJ,NSEG,NBC,NMTL
C* * * * *
C      INITIALIZE
C* * * * *
      ISEG=-1
      PI=3.1415927
      DO 110 J=1,100
      DO 100 I=1,25
      NCODE(I,J)=0
      AR(I,J)=0.
      AZ(I,J)=0.
      JMAX(I)=0
100  JMIN(I)=MAXI
      IMIN(J)=MAXJ
110  IMAX(J)=0
C* * * * *
C      LINE SEGMENT CARDS

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C* * * * *
150 ISEG=ISEG+1
159 IF(ISEG.EQ.NSEG) GO TO 400
    READ(5,1001) I1,J1,R1,Z1,I2,J2,R2,Z2,I3,J3,R3,Z3,IPTION
    WRITE(6,2001) I1,J1,R1,Z1,I2,J2,R2,Z2,I3,J3,R3,Z3,IPTION
    IPTION=IPTION+1
    AR(I1,J1)=R1
    AZ(I1,J1)=Z1
    NCODE(I1,J1)=1
    CALL MNIMX(I1,J1)
    GO TO (150,200,200,300,300,200,200), IPTION
C* * * * *
C    GENERATE STRAIGHT LINES ON BOUNDARY
C* * * * *
200    DI= ABS(FLOAT(I2-I1))
        DJ= ABS(FLOAT(J2-J1))
        AR(I2,J2)=R2
        AZ(I2,J2)=Z2
        NCODE(I2,J2)=1
        CALL MNIMX(I2,J2)
        ISTRT=I1
        ISTOP=I2
        JSTRT=J1
        JSTOP=J2
        DIFF=MAX1(DI,DJ)
        ITER=DIFF-1.
        IINC=0
        JINC=0
        IF(I2.NE.I1) IINC=(I2-I1)/IABS(I2-I1)
        IF(J2.NE.J1) JINC=(J2-J1)/IABS(J2-J1)
        KAPPA=1
        IF(I2.NE.I1.AND.J2.NE.J1.AND.IPTION.NE.3) KAPPA=2
        IF(KAPPA.EQ.2) DIFF=2.*DIFF
        RINC=(R2-R1)/DIFF
        ZINC=(Z2-Z1)/DIFF
        WRITE(6,2002) DI,DJ,DIFF,RINC,ZINC,ITER,IINC,JINC,KAPPA
C
C    CHECK FOR INPUT ERROR
C
        IF(KAPPA.NE.2.OR.DI.EQ.DJ) GO TO 210
        WRITE(6,2003)
        GO TO 150
C
C    INTERPOLATE
C
210    I=I1
        J=J1
        WRITE(6,2004)
        DO 230 M=1,ITER
            IF(ITER.EQ.0.AND.IPTION.EQ.2) GO TO 230
            IF(ITER.EQ.0.AND.IPTION.EQ.6) GO TO 230
            IF(ITER.EQ.0.AND.IPTION.EQ.7) GO TO 230

```

```

      IF(KAPPA.EQ.2) GO TO 220
      IOLD=I
      I=I+IINC
      JOLD=J
      J=J+JINC
      AR(I,J)=AR(IOLD,JOLD)+RINC
      AZ(I,J)=AZ(IOLD,JOLD)+ZINC
      WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
      CALL MNIMX(I,J)
      NCODE(I,J)=1
      GO TO 230
220  CONTINUE
      IF(I1.GT.I2.AND.IPTION.EQ.7) GO TO 221
      IF(I1.LT.I2.AND.IPTION.EQ.6) GO TO 221
      IOLD=I
      I=I+IINC
      AR(I,J)=AR(IOLD,J)+RINC
      AZ(I,J)=AZ(IOLD,J)+ZINC
      WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
      NCODE(I,J)=1
      CALL MNIMX(I,J)
      JOLD=J
      J=J+JINC
      AR(I,J)=AR(I,JOLD)+RINC
      AZ(I,J)=AZ(I,JOLD)+ZINC
      NCODE(I,J)=1
      WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
      CALL MNIMX(I,J)
      GO TO 230
221  JOLD=J
      J=J+JINC
      AR(I,J)=AR(I,JOLD)+RINC
      AZ(I,J)=AZ(I,JOLD)+ZINC
      NCODE(I,J)=1
      WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
      CALL MNIMX(I,J)
      IOLD=I
      I=I+IINC
      AR(I,J)=AR(IOLD,J)+RINC
      AZ(I,J)=AZ(IOLD,J)+ZINC
      NCODE(I,J)=1
      WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
      CALL MNIMX(I,J)
230  CONTINUE
      IF(KAPPA.EQ.1) GO TO 150
      IF(I1.GT.I2.AND.IPTION.EQ.7) GO TO 231
      IF(I1.LT.I2.AND.IPTION.EQ.6) GO TO 231
      IOLD=I
      I=I+IINC
      AR(I,J)=AR(IOLD,J)+RINC
      AZ(I,J)=AZ(IOLD,J)+ZINC
      GO TO 232

```

```

231 CONTINUE
    JOLD=J
    J=J+JINC
    AR(I,J)=AR(I,JOLD)+RINC
    AZ(I,J)=AZ(I,JOLD)+ZINC
232 CONTINUE
    NCODE(I,J)=1
    WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
    CALL MNIMX(I,J)
    GO TO 150
C* * * * *
C    GENERATE CIRCULAR ARCS ON BOUNDARY
C* * * * *
300 AR(I2,J2)=R2
    AZ(I2,J2)=Z2
    NCODE(I2,J2) = 1
    CALL MNIMX(I2,J2)
    IF(IPTION.EQ.5) GO TO 320
C
C    FIND CENTER OF CIRCLE
C
    AR(I3,J3)=R3
    AZ(I3,J3)=Z3
    NCODE(I3,J3)=1
    CALL MNIMX(I3,J3)
    SLAC=(Z2-Z1)/(R2-R1)
    SLBF=-1./SLAC
    SLCE=(Z3-Z2)/(R3-R2)
    SLDF=-1./SLCE
C
C    CHECK FOR INPUT ERROR
C
    IF(ABS(SLAC-SLCE).GT..001) GO TO 310
    WRITE(6,2006) R1,Z1,R2,Z2,R3,Z3,SLAC,SLCE
    GO TO 150
310 R4=R1+(R2-R1)/2.
    Z4=Z1+(Z2-Z1)/2.
    R5=R2+(R3-R2)/2.
    Z5=Z2+(Z3-Z2)/2.
    BBF=Z4-SLBF*R4
    BDF=Z5-SLDF*R5
    RC=(BBF-BDF)/(SLDF-SLBF)
    ZC=SLBF*RC+BBF
    WRITE(6,2007) RC,ZC
    KAPPA=1
    GO TO 330
320 KAPPA=2
    RC=R3
    ZC=Z3
330 ISTRT=I1
    ISTOP=I2
    JSTRT=J1

```

```

JSTP=J2
RSTRT=R1
RSTP=R2
ZSTRT=Z1
ZSTP=Z2
340 CALL ANGLE(RSTRT,ZSTRT,RC,ZC,ANG1)
CALL ANGLE(RSTP,ZSTP,RC,ZC,ANG2)
IF(ANG2.LE.ANG1) ANG2=2.0*PI+ANG2
C
C FIND ANGULAR INCREMENT
C
DI= ABS(FLOAT(ISTP-ISTRT))
DJ= ABS(FLOAT(JSTP-JSTRT))
IINC=0
JINC=0
IF(ISTRT.NE.ISTP) IINC=(ISTP-ISTRT)/IABS(ISTP-ISTRT)
IF(JSTRT.NE.JSTP) JINC=(JSTP-JSTRT)/IABS(JSTP-JSTRT)
LAMDA=1
IF(IINC.NE.0.AND.JINC.NE.0) LAMDA=2
DIFF=MAX1(DI,DJ)
ITER=DIFF-1.
IF(LAMDA.EQ.2) DIFF=2.*DIFF
DELPHI=(ANG2-ANG1)/DIFF
WRITE(6,2008) ANG1,ANG2,DIFF,DELPHI
C
C CHECK FOR INPUT ERROR
C
IF(LAMDA.NE.2.OR.DI.EQ.DJ) GO TO 350
WRITE(6,2003)
GO TO 150
350 IO=ISTRT
JO=JSTRT
WRITE(6,2004)
C
C INTERPOLATE
C
NPT=IABS(I2-I1)+IABS(J2-J1)-1
DO 380 M=1,ITER
359 IF(LAMDA.EQ.2) GO TO 360
I=IO+IINC
J=JO+JINC
CALL MNIMX(I,J)
NCODE(I,J)=1
CALL CIRCLE(ANG1,DELPHI,RSTRT,ZSTRT,RC,ZC,I,J)
WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
GO TO 370
360 I=IO+IINC
J=JO
NCODE(I,J)=1
CALL MNIMX(I,J)
CALL CIRCLE(ANG1,DELPHI,RSTRT,ZSTRT,RC,ZC,I,J)
WRITE(6,2005) I,J,AR(I,J),AZ(I,J)

```

```

J=JO+JINC
NCODE(I,J)=1
CALL MNIMX(I,J)
CALL CIRCLE(ANG1,DELPHI,RSTRT,ZSTRT,RC,ZC,I,J)
WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
370 IO=I
380 JO=J
IF(LAMDA.NE.2) GO TO 390
I=IO+IINC
NCODE(I,J)=1
CALL MNIMX(I,J)
CALL CIRCLE(ANG1,DELPHI,RSTRT,ZSTRT,RC,ZC,I,J)
WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
390 IF(KAPPA.EQ.2) GO TO 150
ISTRT=I2
ISTP=I3
JSTRT=J2
JSTP=J3
RSTRT=R2
RSTP=R3
ZSTRT=Z2
ZSTP=Z3
KAPPA=2
399 GO TO 340
C* * * * *
C CALCULATE COORDINATES OF INTERIOR POINTS
C* * * * *
400 IF(MAXJ.LE.2) GO TO 430
J2=MAXJ-1
DO 420 N=1,500
RESID=0.
DO 410 J=2,J2
I1=IMIN(J)+1
I2=IMAX(J)-1
DO 410 I=I1,I2
IF(NCODE(I,J).EQ.1) GO TO 410
DR=(AR(I+1,J)+AR(I-1,J)+AR(I,J+1)+AR(I,J-1))/4.-AR(I,J)
DZ=(AZ(I+1,J)+AZ(I-1,J)+AZ(I,J+1)+AZ(I,J-1))/4.-AZ(I,J)
RESID=RESID+ABS(DR)+ABS(DZ)
AR(I,J)=AR(I,J)+1.8*DR
AZ(I,J)=AZ(I,J)+1.8*DZ
410 CONTINUE
IF(N.EQ.1) RES1=RESID
IF(N.EQ.1.AND.RESID.EQ.0.)GO TO 430
IF(RESID/RES1.LT.1.E-5) GO TO 430
420 CONTINUE
430 WRITE(6,2009) N
C* * * * *
C CALL POINTS
C* * * * *
1000 FORMAT (5I5)
1001 FORMAT (3(2I3,2F8.3),I5)

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2000 FORMAT (30H1 MESH GENERATION INFORMATION//
1 41H0 MAXIMUM VALUE OF I IN THE MESH-----I3/
2 41H0 MAXIMUM VALUE OF J IN THE MESH-----I3/
3 41H0 NUMBER OF LINE SEGMENT CARDS-----I3/
4 41H0 NUMBER OF BOUNDARY CONDITION CARDS----I3/
5 41H0 NUMBER OF MATERIAL BLOCK CARDS-----I3///)
2001 FORMAT (/88H INPUT I1 J1 R1 Z1 I2 J2 R2 Z
12 I3 J3 R3 Z3 IPTION/8X,3(2I4,2F8.4),I6)
2002 FORMAT (5H DI=F4.0,5H DJ=F4.0,7H DIFF=F4.0,7H RINC=F8.3,7H ZI
1NC=F8.3,7H ITER=I3,7H IINC=I3,7H JINC=I3,8H KAPPA=I1)
2003 FORMAT(1X,38H**BAD INPUT--THIS LINE IS NOT DIAGONAL)
2004 FORMAT (30H I J AR AZ)
2005 FORMAT (2I5,2F11.6)
2006 FORMAT (51H ** BAD INPUT - THESE POINTS DO NOT DEFINE A CIRCLE,/,
13X,6F12.4,10X,2E20.8)
2007 FORMAT(19H CENTER COORDINATE,(F11.6,1X,F11.6,1X))
2008 FORMAT (7H ANGL=F9.6,7H ANG2=F9.6,7H DIFF=F3.0,9H DELPHI=F9.6)
2009 FORMAT (/30H COORDINATES CALCULATED AFTER I3,11H ITERATIONS)
RETURN
END
SUBROUTINE MNIMX(I,J)
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
IF(J.LT.JMIN(I)) JMIN(I)=J
IF(J.GT.JMAX(I)) JMAX(I)=J
IF(I.LT.IMIN(J)) IMIN(J)=I
IF(I.GT.IMAX(J)) IMAX(J)=I
RETURN
END
SUBROUTINE ADINA(NFACE,FTHETA)
INTEGER CODE
COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
1NPNUM(25,80),T(1000),XT(1000)
COMMON/ARG/RRR(5),ZZZ(5),RR(4),ZZ(4),S(15,15),P(15),TT(6),
1H(6,15),CRZ(6,6),XI(10),ANGLE(4),SIG(18),EPS(18),N
COMMON/ELDATA/BETA(1000),EPR(1000),PR(200),SH(200),IX(1000,5),
1IP(200),JP(200),IS(200),JS(200),ALPHA(1000),IT(200),JT(200),
2ST(200),INP(1000),JNP(1000)
COMMON/BASIC/ACELZ,ANGVEL,ANGACC,TREF,VOL,NUMNP,NUMEL,NUMPC,NUMSC,
1NUMST
COMMON/NXMESH/THETAN(4),NST(4),NUMS(4,5),NPC(8,8)
DIMENSION NPG(25,80,9),FTHETA(9),NCOD(8),NEL(8),ID(6)
COMMON/ANS1/NUMELS(4),NUMNPS(4)
COMMON/NXDATA/NTP,NTYPS,NTS,NTOTS
COMMON/NONAXI/S1(30,30),P1(30),THETA,BS1(6,30)
COMMON/SOLVE/X(4428),Y(4428),TEM(4428),NUMTC,MBAND
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
COMMON/CONVRG/IDONE
COMMON/PLANE/NPP
COMMON/RESULT/BS(6,15),D(6,6),C(6,6),AR,BB(6,9),CNS(6,6)
COMMON/MATP/RO(6),E(12,16,6),EE(16),AOFTS(6)
COMMON/TOTAL/NELN
DATA NPG/18000*0/

```



```

      NI=NST(NTP)
C LOOP ON # OF SEGMENTS OF TYPE NTP
      DO 500 I=1,NI
      DO 200 J=1,NUMNP
      NFL=NUMS(NTP,I)
      NFR=NFL+1
      IP1=INP(J)
      JP1=JNP(J)
      NF=NFL
      DO 200 K=1,2
      NC=CODE(J)+1
      IF(NPG(IP1,JP1,NF).NE.0)GO TO 200
      NPG(IP1,JP1,NF)=IP1+(JP1-1)*25+NF*200
      DO 10 II=1,8
10    ID(II)=0
      IF(NC.EQ.3.OR.NC.EQ.4.OR.NC.EQ.7.OR.NC.EQ.8) ID(1)=1
      IF(NF.EQ.1) ID(3)=1
      IF(NF.EQ.NTOTS+1) ID(2)=1
      IF(R(J).EQ.0.0) ID(2)=1
      IF(R(J).EQ.0.0) ID(3)=1
C
C    WRITE NODAL DATA ON FILE 2
C
      WRITE(2,100)NPG(IP1,JP1,NF),(ID(KK),KK=1,6),Z(J),R(J),FTHETA(NF)
100  FORMAT("X",I4,1X,I4,5I5,3F10.4,4X,"0")
200  NF=NFR
      DO 350 J=1,NUMEL
      NF=NUMS(NTP,I)
      I1=IX(J,1)
      I2=IX(J,2)
      I3=IX(J,3)
      I4=IX(J,4)
      IP1=INP(I1)
      JP1=JNP(I1)
      NEL(1)=NPG(IP1,JP1,NFL)
      IF(IP1.EQ.1)NEL(1)=NPG(IP1,JP1,1)
      NEL(4)=NPG(IP1,JP1,NFR)
      IP1=INP(I2)
      JP1=JNP(I2)
      NEL(2)=NPG(IP1,JP1,NFL)
      NEL(3)=NPG(IP1,JP1,NFR)
      IP1=INP(I4)
      JP1=JNP(I4)
      NEL(5)=NPG(IP1,JP1,NFL)
      IF(IP1.EQ.1)NEL(5)=NPG(IP1,JP1,1)
      NEL(8)=NPG(IP1,JP1,NFR)
      IP1=INP(I3)
      JP1=JNP(I3)
      NEL(6)=NPG(IP1,JP1,NFL)
      NEL(7)=NPG(IP1,JP1,NFR)
      NELN=NELN+1
      NZ=0

```

```

      N8=8
      WRITE(3,300) NELN,N8,N8,NZ,IX(J,5),NELN,NZ,NZ
300  FORMAT(8I5,F10.0)
      WRITE(3,301) (NEL(K),K=1,8)
301  FORMAT(8I5)
C
C      WRITE MATERIAL AXES DATA ON FILE 4
C
      NPI=NEL(1)+7000
      NPJ=NEL(1)+8000
      NPK=NEL(1)+9000
      WRITE(4,302) NELN,NPI,NPJ,NPK
302  FORMAT(4I5)
C
C      WRITE NODAL POINTS FOR MATERIAL AXES
C
      FTRAD=FTHETA(NF)/57.29578
      CA=COS(ALPHA(J))
      CB=COS(BETA(J))
      SA=SIN(ALPHA(J))
      SB=SIN(BETA(J))
      CF=COS(FTRAD)
      SF=SIN(FTRAD)
      XPI=0.0
      YPI=0.0
      ZPI=0.0
      XPJ=CA*CB
      YPJ=CA*SB*CF+SA*SF
      ZPJ=CA*SB*SF-SA*CF
      XPK=SA*CB
      YPK=SA*SB*CF-CA*SF
      ZPK=SA*SB*SF+CA*CF
      WRITE(7,303) NPI,NZ,NZ,NZ,NZ,NZ,NZ,NZ,XPI,YPI,ZPI
      WRITE(7,303) NPJ,NZ,NZ,NZ,NZ,NZ,NZ,NZ,XPJ,YPJ,ZPJ
      WRITE(7,303) NPK,NZ,NZ,NZ,NZ,NZ,NZ,NZ,XPK,YPK,ZPK
303  FORMAT(1X,I4,1X,I4,5I5,3F10.4,4X,"0")
350  CONTINUE
      DO 500 L=1,NUMPC
      IP1=INP(IP(L))
      JP1=JNP(IP(L))
      IP2=INP(JP(L))
      JP2=JNP(JP(L))
      NEL(1)=NPG(IP1,JP1,NFL)
      NEL(2)=NPG(IP2,JP2,NFL)
      NEL(3)=NPG(IP2,JP2,NFR)
      NEL(4)=NPG(IP1,JP1,NFR)
      NCUR=1
      WRITE(1,400) NCUR,(NEL(K),K=1,4)
      WRITE(1,401) PR(L),PR(L),PR(L),PR(L)
400  FORMAT(9I5)
401  FORMAT(5F10.0,I5)
500  CONTINUE

```

```

END
FUNCTION NODE(I,J)
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
NODE=0
DO 100 JJ=1,J
  NSTART=IMIN(JJ)
  NSTOP=IMAX(JJ)
  DO 100 II=NSTART,NSTOP
    NODE=NODE+1
    IF(JJ.EQ.J.AND.II.EQ.I) RETURN
100 CONTINUE
  RETURN
END
SUBROUTINE POINTS
INTEGER CODE
COMMON/BASIC/ACELZ,ANGVEL,ANGACC,TREF,VOL,NUMNP,NUMEL,NUMPC,NUMSC,
1NUMST
COMMON/MATP/RO(6),E(12,16,6),EE(16),AOFTS(6)
COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
1INPNUM(25,80),T(1000),XT(1000)
COMMON/ELDATA/BETA(1000),EPR(1000),PR(200),SH(200),IX(1000,5),
1IP(200),JP(200),IS(200),JS(200),ALPHA(1000),IT(200),JT(200),
2ST(200),INP(1000),JNP(1000)
COMMON/SOLVE/X(4428),Y(4428),TEM(4428),NUMTC,MBAND
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
COMMON/PLANE/NPP
DIMENSION AR(25,80),AZ(25,80),MATRIL(100,5),BLKANG(100),BLKALF(1
100)
DIMENSION IBNG(100),NBNG(100)
EQUIVALENCE (R(1),AR),(Z(1),AZ)
C ESTABLISH NODAL POINT INFORMATION
C* * * * *
  NEL=0
  NODSUM=0
  DO 100 J=1,MAXJ
    NSTART=IMIN(J)
    NSTOP=IMAX(J)
    DO 100 I=NSTART,NSTOP
100 NODSUM=NODSUM+1
    NELSUM=0
    JJMAX=MAXJ-1
    DO 110 JJ=1,JJMAX
      NSTOP=MIN0(IMAX(JJ),IMAX(JJ+1))-1
      NSTART=MAX0(IMIN(JJ),IMIN(JJ+1))
      DO 110 II=NSTART,NSTOP
110 NELSUM=NELSUM+1
    NUMNP=NODSUM
    NUMEL=NELSUM
    DO 120 J=1,MAXJ
      NSTART=IMIN(J)
      NSTOP=IMAX(J)
      DO 120 I=NSTART,NSTOP

```

```

      NPNUM(I,J)=NODE(I,J)
      NP=NPNUM(I,J)
      INP(NP)=I
      JNP(NP)=J
      R(NP)=AR(I,J)
120  Z(NP)=AZ(I,J)
C* * * * *
C      READ AND ASSIGN BOUNDARY CONDITIONS
C* * * * *
C      INITIALIZE
C* * * * *
      DO 130 I=1,NUMNP
      CODE(I)=0
      IF(R(I).EQ.0..AND.NPP.EQ.0) CODE(I)=1.
      XR(I)=0.
      XZ(I)=0.
      XT(I)=0.0
130  T(I)=0.
      IF(NBC.EQ.0) GO TO 210
      DO 200 IBCON=1,NBC
      READ(5,1002) I1,I2,J1,J2,ICN,RCON,ZCON,TCON
      DO 200 I=I1,I2
      DO 200 J=J1,J2
      NP=NPNUM(I,J)
      CODE(NP)=ICN
      XR(NP)=RCON
      XT(NP)=TCON
200  XZ(NP)=ZCON
210  MPRINT=0
      DO 230 J=1,MAXJ
      NSTART=IMIN(J)
      NSTOP=IMAX(J)
      DO 230 I=NSTART,NSTOP
      NP=NPNUM(I,J)
      IF(MPRINT.NE.0) GO TO 220
      WRITE(6,2000)
      MPRINT=59
220  MPRINT=MPRINT-1
230  WRITE(6,2001) I,J,NP,CODE(NP),R(NP),Z(NP),XR(NP),XZ(NP),XT(NP)
C* * * * *
C      ASSIGN MATERIALS IN BLOCKS
C* * * * *
      DO 300 M1=1,NUMEL
300  IX(M1,5)=0
      DO 310 IMTL=1,NMTL
      READ(5,1000) MTL,(MATRIL(IMTL,IM),IM=2,5),BLKANG(IMTL),BLKALF(IMT
1L),IBNG(IMTL),NBNG(IMTL)
310  MATRIL(IMTL,1)=MTL
C* * * * *
C      ESTABLISH ELEMENT INFORMATION
C* * * * *
      JJMAX=MAXJ-1

```

```

N=0
MTL=1
KTL=1
DO 440 JJ=1,JJMAX
NSTOP=MIN0(IMAX(JJ),IMAX(JJ+1))-1
NSTART=MAX0(IMIN(JJ),IMIN(JJ+1))
DO 440 II=NSTART,NSTOP
NEL=NEL+1
DO 400 IMTL=1,NMTL
IF(II.LT.MATRIL(IMTL,2)) GO TO 400
IF(II.GE.MATRIL(IMTL,3)) GO TO 400
IF(JJ.LT.MATRIL(IMTL,4)) GO TO 400
IF(JJ.GE.MATRIL(IMTL,5)) GO TO 400
KAT=IMTL
MAT=MATRIL(IMTL,1)
400 CONTINUE
IF(KAT.EQ.KTL) GO TO 410
KTL=KAT
MTL=MAT
GO TO 420
410 IF(II.EQ.NSTART) GO TO 420
IF(JJ.NE.JJMAX.OR.II.NE.NSTOP) GO TO 440
M=NEL+1
IANG=ICNG
NANG=NCNG
GO TO 421
420 I=NPNUM(II,JJ)
J=I+1
K=NPNUM(II+1,JJ+1)
L=K-1
M=NEL
IX(M,1)=I
IX(M,2)=J
IX(M,3)=K
IX(M,4)=L
IX(M,5)=MTL
BETA(M)=BLKANG(KTL)
ALPHA(M)=BLKALF(KTL)
IANG=ICNG
NANG=NCNG
ICNG=IBNG(KTL)
NCNG=NBNG(KTL)
421 NC=2
430 N=N+1
IF(M.LE.N) GO TO 440
IX(N,1)=IX(N-1,1)+1
IX(N,2)=IX(N-1,2)+1
IX(N,3)=IX(N-1,3)+1
IX(N,4)=IX(N-1,4)+1
IX(N,5)=IX(N-1,5)
BETA(N)=BETA(N-1)
IF(IANG.EQ.1) GO TO 442

```

```

      ALPHA(N)=ALPHA(N-1)
      GO TO 443
442  CONTINUE
      IF(NC.GT.NANG) GO TO 444
      ALPHA(N)=ALPHA(N-1)
      GO TO 443
444  NC=1
      ALPHA(N)=-ALPHA(N-1)
443  CONTINUE
      NC=NC+1
      IF(M.GT.N) GO TO 430
440  CONTINUE
      IF(NUMNP.GT.2000) WRITE(6,2002)
C* * * * *
C    SET NODAL POINT TEMPERATURE TO REFERENCE TEMPERATURE
C* * * * *
      IF(NUMTC.NE.0) RETURN
      DO 500 N=1,NUMNP
500   T(N)=TREF
1000  FORMAT (5I5,2F10.0,2I5)
1002  FORMAT(4I5,I10,3F10.0)
2000  FORMAT (128H1      I      J      NP      TYPE      R-ORDINATE      Z-ORDINA
1TE R LOAD OR DISPLACEMENT Z LOAD OR DISPLACEMENT T LOAD OR DISP
2LACEMENT)
2001  FORMAT (2I5,I6,I12,F13.6,F14.6,E26.7,E24.7,E24.7)
2002  FORMAT (35H BAD INPUT - TOO MANY NODAL POINTS)
      RETURN
      END
      SUBROUTINE TEMP(R,Z,T)
      COMMON/SOLVE/X(4428),Y(4428),TEM(4428),NUMTC,MBAND
      DIMENSION SMALL(20),ISM(20)
C* * * * *
C    INITIALIZE
C* * * * *
      J=1
      JMAX=16
      IF(NUMTC.LT.JMAX) JMAX=NUMTC
      DO 10 I=1,JMAX
      SMALL(I)=0.
10    ISM(I)=0
C* * * * *
C    FIND THE JMAX CLOSEST POINTS
C* * * * *
      DO 50 I=1,NUMTC
      DSQ=(X(I)-R)**2+(Y(I)-Z)**2
      IF(DSQ.GT..1E-4) GO TO 20
      T=TEM(I)
      RETURN
20    IF(I.EQ.1) SMALL(1)=DSQ
      IF(I.EQ.1) ISM(1)=1
      IF(I.EQ.1) GO TO 50
      IF(SMALL(J).LE.DSQ.AND.J.LT.JMAX) SMALL(J+1)=DSQ

```

```

      IF (SMALL(J).LE.DSQ.AND.J.LT.JMAX) ISM(J+1)=I
      IF (SMALL(J).LE.DSQ) GO TO 40
      DO 30 K=1,J
      JB=J-K +1
      IF (JB.EQ.0) GO TO 40
      SMALL(JB+1)=SMALL(JB)
      ISM(JB+1)=ISM(JB)
      SMALL(JB)=DSQ
      ISM(JB)=I
      IF (JB.EQ.1) GO TO 40
      IF (SMALL(JB-1).LE.DSQ) GO TO 40
30  CONTINUE
40  IF (J.LT.JMAX) J=J+1
50  CONTINUE
C* * * * *
C    FIND THE THIRD TEMPERATURE POINT BY AREA TEST
C* * * * *
      JCHK=JMAX-2
      J=0
      I1=ISM(1)
      I2=ISM(2)
60  I3=ISM(J+3)
      AREA=.50*(Y(I1)*X(I3)-Y(I3)*X(I1)+Y(I3)*X(I2)-Y(I2)*X(I3)+
1     Y(I2)*X(I1)-Y(I1)*X(I2))
      D1=(X(I2)-X(I1))**2+(Y(I2)-Y(I1))**2
C    IF D1 IS APPROXIMATELY 0. IT IS ASSUMED THAT THERE EXISTS A
C    DUPLICATION OF INPUT
      IF (D1.GT..1E-3) GO TO 70
      I2=I3
      J=J+1
      GO TO 60
70  IF (AREA**2.GT..1*D1*SMALL(1)) GO TO 80
      J=J+1
      IF (J.LT.JCHK) GO TO 60
      WRITE(6,2000) I1,I2,I3,J
      T=TEM(I1)
      RETURN
C* * * * *
C    FIND TEMPERATURE INTERCEPT
C* * * * *
80  DETA=Y(I1)*(TEM(I3)-TEM(I2))+Y(I2)*(TEM(I1)-TEM(I3))
1     +Y(I3)*(TEM(I2)-TEM(I1))
      DETB=X(I1)*(TEM(I2)-TEM(I3))+X(I2)*(TEM(I3)-TEM(I1))
1     +X(I3)*(TEM(I1)-TEM(I2))
      DETC=TEM(I1)*(X(I2)*Y(I3)-X(I3)*Y(I2))+TEM(I2)*(X(I3)*Y(I1)-X(I1)*
1     Y(I3))+TEM(I3)*(X(I1)*Y(I2)-X(I2)*Y(I1))
      T=(DETA*R+DETB*Z+DETC)/(2.*AREA)
2000 FORMAT (28H ERROR IN TEMPERATURE INPUT,5H I1=I4,5H I2=I4,
15H I3=I4,4H J=I4)
      RETURN
      END
      SUBROUTINE TEM2(NUMNP)

```

```

      INTEGER CODE
      COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
1NPNUM(25,80),T(1000),XT(1000)
      READ(5,1000) TCONST
      DO 100 N=1,NUMNP
100   T(N)=TCONST
1000  FORMAT(F10.0)
      RETURN
      END
      END
N

```


APPENDIX B

Listing of the NASGEN Program

```

PROGRAM NASGEN(INPUT,OUTPUT,NAS,TAPE5=INPUT,TAPE6=OUTPUT,TAPE1=
1 NAS)
  INTEGER CODE
  COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
  INPNUM(25,80),T(1000),XT(1000)
  COMMON/ARG/RRR(5),ZZZ(5),RR(4),ZZ(4),S(15,15),P(15),TT(6),
  1H(6,15),CRZ(6,6),XI(10),ANGLE(4),SIG(18),EPS(18),N
  COMMON/ELDATA/BETA(1000),EPR(1000),PR(200),SH(200),IX(1000,5),
  1IP(200),JP(200),IS(200),JS(200),ALPHA(1000),IT(200),JT(200),
  2ST(200),INP(1000),JNP(1000)
  COMMON/BASIC/ACELZ,ANGVEL,ANGACC,TREF,VOL,NUMNP,NUMEL,NUMPC,NUMSC,
  1NUMST
  COMMON/NXMESH/THETAN(4),NST(4),NUMS(4,5),NPC(8,8)
  COMMON/ANS1/NUMELS(4),NUMNPS(4)
  COMMON/NXDATA/NTP,NTYPS,NTS,NTOTS
  COMMON/NONAXI/S1(30,30),P1(30),THETA,BS1(6,30)
  COMMON/SOLVE/X(4428),Y(4428),TEM(4428),NUMTC,MBAND
  COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
  COMMON/CONVRG/IDONE
  COMMON/PLANE/NPP
  COMMON/RESULT/BS(6,15),D(6,6),C(6,6),AR,BB(6,9),CNS(6,6)
  COMMON/MATP/RO(6),E(12,16,6),EE(16),AOFTS(6)
  DIMENSION TITLE(20),FTHETA(8)
C* * * * *
C  READ AND WRITE CONTROL INFORMATION
C* * * * *
  READ(5,3000) NTYPS,NTOTS
  DO 150 I=1,NTYPS
150 READ(5,3001) THETAN(I),NST(I)
    DO 151 I=1,NTYPS
      J2 =NST(I)
151 READ(5,3000) (NUMS(I,J),J=1,J2)
    DO 152 I=1,NTOTS
152 READ(5,3002) (NPC(I,J),J=1,8)
3000 FORMAT(8I10)
3001 FORMAT(F10.5,I10)
3002 FORMAT(8I10)
  NFACE=NTOTS+1
  FTHETA(1)=0.0
  DO 4100 I=1,NTOTS
    DO 4000 J=1,NTYPS
      K2=NST(J)
      DO 4000 K=1,K2
4000 IF(NUMS(J,K).EQ.I)GO TO 4100
4100 FTHETA(I+1)=FTHETA(I)+THETAN(J)
  WRITE(6,4200)((FTHETA(I),I),I=1,NTOTS)
4200 FORMAT(" ANGLE IN DEGREES ",5X," BEGINNING SEGMENT #"/
  1 (E20.10,I10))
  WRITE(6,3010)
3010 FORMAT("1","SEGMENT DATA FOR NONAXISYMMETRIC PROBLEM")
  WRITE(6,3011) NTYPS,NTOTS
3011 FORMAT (" "," NUMBER OF TYPES OF SEGMENTS = ",I5,/,

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```

1          " NUMBER OF TOTAL SEGMENTS      =",I5)
  DO 153 I=1,NTYPS
    WRITE(6,3012) I,THETAN(I),NST(I)
3012 FORMAT(" ",///," SEGMENT TYPE = ",I5/,"      THETA = ",F10.5/,
1  " NUMBER OF SEGMENTS OF THIS TYPE = ",I5)
    J2 = NST(I)
    WRITE(6,3013) (NUMS(I,J),J=1,J2)
3013 FORMAT(" ", " SEGMENT NUMBERS IN GLOBAL SYSTEM ARE ",5I5)
153 CONTINUE
    DO 154 I=1,NTOTS
154  WRITE(6,3014) I, (NPC(I,J),J=1,8)
3014 FORMAT(" ", "CONNECTING NODES FOR SEGMENT",I5," ARE",8I5)
    DO 950 NTP = 1,NTYPS
      THETA= THETAN(NTP) /57.295780
50  READ(5,1000 ) TITLE,NNLA,NUMTC,NUMMAT,NUMPC,NUMSC,NUMST,TREF
      1,INERT,NLINC,INCI,INCF,IPLOT
      WRITE(6,2000) TITLE,NNLA,NUMTC,NUMMAT,NUMPC,NUMSC,NUMST,TREF,INERT,
      1NLINC
      NPP=0
C* * * * *
C  GENERATE FINITE ELEMENT MESH
C* * * * *
100 CALL MESH
    NUMELS(NTP) = NUMEL
    NUMNPS(NTP) = NUMNP
C* * * * *
C  READ AND WRITE TEMPERATURE DATA
C* * * * *
103 IF(NUMTC.EQ.0) GO TO 440
    IF(NUMTC.GT.0) READ(5,1001) (X(I),Y(I),TEM(I),I=1,NUMTC)
    IF(NUMTC.EQ.-2) CALL TEM2(NUMNP)
    IF(NUMTC.EQ.-2) GO TO 440
    MPRINT=0
    DO 210 I=1,NUMTC
      IF(MPRINT.NE.0) GO TO 200
      WRITE(6,2001)
      MPRINT=59
200 MPRINT=MPRINT-1
210 WRITE(6,2002) X(I),Y(I),TEM(I)
      MPRINT=0
      DO 230 N=1,NUMNP
        IF(MPRINT.NE.0) GO TO 220
        WRITE(6,2003)
        MPRINT=59
220 MPRINT=MPRINT-1
        CALL TEMP(R(N),Z(N),T(N))
230 WRITE(6,2004) N,R(N),Z(N),T(N)
440 MPRINT=0
    DO 460 N=1,NUMEL
      IF(MPRINT.NE.0) GO TO 450
      WRITE(6,2008)
      MPRINT=59

```

```

450 MPRINT=MPRINT-1
    II=IX(N,1)
    JJ=IX(N,2)
    KK=IX(N,3)
    LL=IX(N,4)
C
C    TEM IS TEMPORARY STORAGE FOR ELEMENT TEMPERATURES
C
    TEM(N)=(T(II)+T(JJ)+T(KK)+T(LL))/4.00
460 WRITE(6,2009) N, (IX(N,I), I=1,5), BETA(N), ALPHA(N), TEM(N)
    DO 470 K=1, NUMEL
470 T(K)=TEM(K)
C* * * * *
C    READ AND WRITE MATERIAL PROPERTIES
C* * * * *
500 CONTINUE
    DO 510 M=1, NUMMAT
    READ(5,1004) MTYPE, (NT, RO(MTYPE), AOFTS(MTYPE))
    WRITE(6,2010) MTYPE, NT, RO(MTYPE)
    READ(5,1005) ((E(I,J,MTYPE), J=1,14), I=1, NT)
    IF(AOFTS(MTYPE).NE.1.) WRITE(6,2011) ((E(I,J,MTYPE), J=1,13), I=1, NT)
    IF(AOFTS(MTYPE).EQ.1.) WRITE(6,2012) ((E(I,J,MTYPE), J=1,13), I=1, NT)
    DO 510 I=NT,12
    DO 510 J=1,16
510 E(I,J,MTYPE)=E(NT,J,MTYPE)
    DO 900 NL=1,NLINC
    WRITE(6,2030) NL
    ACELZ=0.00
    ANGVEL=0.00
    ANGACC=0.00
    IF(INERT.EQ.0) GO TO 511
    IF(NL.NE.1.AND. INCI.EQ.0) GO TO 511
C*****
C    READ AND WRITE DYNAMIC FORCES
C*****
    READ(5,1030) ACELZ, ANGVEL, ANGACC
    WRITE(6,2031) ACELZ, ANGVEL, ANGACC
511 CONTINUE
C* * * * *
C    READ AND WRITE PRESSURE AND SHEAR BOUNDARY CONDITIONS
C* * * * *
    IF(NL.NE.1.AND. INCF.EQ.0) GO TO 700
600 IF(NUMPC.EQ.0) GO TO 630
    MPRINT=0
    DO 620 L=1, NUMPC
    IF(MPRINT.NE.0) GO TO 610
    WRITE(6,2013)
    MPRINT=58
610 MPRINT=MPRINT-1
    READ(5,1006) IP(L), JP(L), PR(L)
620 WRITE(6,2014) IP(L), JP(L), PR(L)
630 IF(NUMSC.EQ.0) GO TO 701

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      MPRINT=0
      DO 650 L=1,NUMSC
      IF(MPRINT.NE.0) GO TO 640
      WRITE(6,2015)
      MPRINT=58
640  MPRINT=MPRINT-1
      READ(5,1006) IS(L),JS(L),SH(L)
650  WRITE(6,2014) IS(L),JS(L),SH(L)
701  IF(NUMST.EQ.0) GO TO 700
      MPRINT=0
      DO 680 L=1,NUMST
      IF(MPRINT.NE.0) GO TO 670
      WRITE(6,2025)
      MPRINT=58
670  MPRINT=MPRINT-1
      READ(5,1006) IT(L),JT(L),ST(L)
680  WRITE(6,2014) IT(L),JT(L),ST(L)
C* * * * *
C    DETERMINE BANDWIDTH, INITIALIZE ELASTIC-PLASTIC RATIO,
C    AND CONVERT BETA FROM DEGREES TO RADIANS
C* * * * *
700  J=0
      DO 710 N=1,NUMEL
      IX(N,5)=IABS(IX(N,5))
      DO 710 I=1,4
      DO 710 L=1,4
      KK=IABS(IX(N,I)-IX(N,L))
      IF(KK.GE.J) J=KK
710  CONTINUE
      MBAND=3*J+3
      IF(NL.GT.1) GO TO 721
      DO 720 N=1,NUMEL
      EPR(N)=1.
      ALPHA(N)=ALPHA(N)/57.295780
720  BETA(N)=BETA(N)/57.295780
721  CONTINUE
900  CONTINUE
      CALL NASTRN(NFACE,FTHETA)
950  CONTINUE
      WRITE(1,4500) ((MTYPE,E(1,4,MTYPE),E(1,10,MTYPE),E(1,7,MTYPE)
1    ,RO(MTYPE)),MTYPE=1,NUMMAT)
4500  FORMAT("MAT1",4X,I8,4E8.2)
      WRITE(1,4600) ACELZ
4600  FORMAT("CORD1C",9X,"1",5X,"101",5X,"102",5X,"103"/"GRID",9X,
1    "101",13X,"0.0",5X,"0.0",5X,"0.0",10X,"123456"/"GRID",9X,
2    "102",13X,"0.0",5X,"0.0",5X,"1.0",10X,"123456"/"GRID",9X,
3    "103",13X,"1.0",5X,"0.0",5X,"1.0",10X,"123456"/"GRAV",11X
4    ,"2",7X,"1",E8.2,5X,"0.0",5X,"0.0",4X,"-1.0"/"PSOLID",
5    9X,"1",7X,"1",7X,"1"/"ENDDATA")
910  CONTINUE
1000  FORMAT(20A4/6I5,F5.0,5I5)
1001  FORMAT(3F10.0)

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1004 FORMAT (2I5,2F10.0)
1005 FORMAT(7F10.0)
1006 FORMAT (2I5,F10.0)
1030 FORMAT(3F10.0)
2000 FORMAT (2H1 ,20A4/
1 33H0  NUMBER OF APPROXIMATIONS-----I4/
2 33H0  NUMBER OF TEMPERATURE CARDS---I4/
3 33H0  NUMBER OF MATERIALS-----I4/
4 33H0  NUMBER OF PRESSURE CARDS-----I4/
5 33H0  NUMBER OF SHEAR CARDS-----I4/
6 33H0  NUMBER OF TORSION CARDS-----I4/
7 33H0  REFERENCE TEMPERATURE-----E12.4/
8 33H0  NUMBER OF INERTIA CARDS-----I4/
9 33H0  NUMBER OF LOAD INCREMENTS-----I4/)
2001 FORMAT (1H1,13X,1HR,14X,1HZ,14X,1HT)
2002 FORMAT (3F15.3)
2003 FORMAT (35H1  N      R      Z      T)
2004 FORMAT (I5,2F10.4,F10.0)
2008 FORMAT (74H1  EL  I  J  K  L  MATERIAL  ANGLE BETA  ANGLE A
1LPHA  TEMPERATURE)
2009 FORMAT (I5,4I4,I8,F11.1,2F13.3)
2010 FORMAT (1H1,"MATERIAL IDENTIFICATION NUMBER =",I2/
11H ,"NO. OF MATERIAL TEMPERATURE CARDS =",I2/
21H ,"MASS DENSITY =",E15.7)
2011 FORMAT (1H ,"TEMPERATURE =",E15.7/
11H ,"MODULUS OF ELASTICITY-EN =",E15.7/
21H ,"MODULUS OF ELASTICITY-ES =",E15.7/
31H ,"MODULUS OF ELASTICITY-ET =",E15.7/
41H ,"POISSON RATIO-NUNS =",E15.7/
51H ,"POISSON RATIO-NUNT =",E15.7/
61H ,"POISSON RATIO-NUST =",E15.7/
71H ,"SHEAR MODULUS-GNS =",E15.7/
81H ,"SHEAR MODULUS-GST =",E15.7/
91H ,"SHEAR MODULUS-GTN =",E15.7/
11H ,"COEFFICIENT OF THERMAL EXPANSION-AN =",E15.7/
21H ,"COEFFICIENT OF THERMAL EXPANSION-AS =",E15.7/
31H ,"COEFFICIENT OF THERMAL EXPANSION-AT =",E15.7/)
2012 FORMAT (1H ,"TEMPERATURE =",E15.7/
11H ,"MODULUS OF ELASTICITY-EN =",E15.7/
21H ,"MODULUS OF ELASTICITY-ES =",E15.7/
31H ,"MODULUS OF ELASTICITY-ET =",E15.7/
41H ,"POISSON RATIO-NUNS =",E15.7/
51H ,"POISSON RATIO-NUNT =",E15.7/
61H ,"POISSON RATIO-NUST =",E15.7/
71H ,"SHEAR MODULUS-GNS =",E15.7/
81H ,"SHEAR MODULUS-GST =",E15.7/
91H ,"SHEAR MODULUS-GTN =",E15.7/
11H ,"FREE THERMAL STRAIN-FN =",E15.7/
21H ,"FREE THERMAL STRAIN-FS =",E15.7/
31H ,"FREE THERMAL STRAIN-FT =",E15.7/)
2013 FORMAT (30H1 PRESSURE BOUNDARY CONDITIONS/20H  I  J  PRESSURE)
2014 FORMAT (2I5,F10.1)

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2015 FORMAT (27H1 SHEAR BOUNDARY CONDITIONS/17H      I      J  SHEAR)
2016 FORMAT (26H  THE SYSTEM CONVERGED IN I2,11H ITERATIONS)
2017 FORMAT (33H  THE SYSTEM DID NOT CONVERGE IN I2,11H ITERATIONS)
2024 FORMAT (43H0 THE AXISYMMETRIC OPTION HAS BEEN SELECTED)
2025 FORMAT(30H1 TORSION BOUNDARY CONDITIONS/17H      I      J  SHEAR)
2030 FORMAT(1H1,"LOAD STEP=",I4)
2031 FORMAT(1H0,"AXIAL ACCELERATION  =",E12.4/
11H0,"ANGULAR VELOCITY      =",E12.4/
21H0,"ANGULAR ACCELERATION=",E12.4)
920 STOP
END
SUBROUTINE ANGLE (R,Z,RC,ZC,ANG)
C FIND ANGLE OF INCLINATION BETWEEN 0 AND 2*PI
C* * * * *
PI=3.1415927
D1=(Z-ZC)
D2=(R-RC)
IF(ABS(R-RC).GT.1.E-8) GO TO 100
ANG=PI/2.
IF(D1.GT.1.E-8) RETURN
ANG=-ANG
RETURN
C* * * * *
C ALLOW CIRCLE TO CROSS AXIS
C* * * * *
100 ANG=ATAN2(D1,D2)
RETURN
END
SUBROUTINE CIRCLE(ANG1,DELPHI,RSTRT,ZSTRT,RC,ZC,I,J)
INTEGER CODE
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
INPNUM(25,80),T(1000),XT(1000)
DIMENSION AR(25,80),AZ(25,80)
EQUIVALENCE (R(1),AR),(Z(1),AZ)
C* * * * *
C FIND INTERSECTION OF LINE AND CIRCLE = NEW R AND Z
C* * * * *
ANG1=ANG1+DELPHI
RR=SQRT((RSTRT-RC)**2+(ZSTRT-ZC)**2)
AR(I,J)=RC+RR*COS(ANG1)
AZ(I,J)=ZC+RR*SIN(ANG1)
RETURN
END
SUBROUTINE MESH
INTEGER CODE
DIMENSION AR(25,80),AZ(25,80),NCODE(25,80)
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
INPNUM(25,80),T(1000),XT(1000)
COMMON/ELDATA/BETA(1000),EPR(1000),PR(200),SH(200),IX(1000,5),
1IP(200),JP(200),IS(200),JS(200),ALPHA(1000),IT(200),JT(200),

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      2ST(200),INP(1000),JNP(1000)
      EQUIVALENCE (R(1),AR),(Z(1),AZ),(IX(1,1),NCODE)
C* * * * *
C      MESH CONTROL INFORMATION
C* * * * *
      READ (5,1000) MAXI,MAXJ,NSEG,NBC,NMTL
      WRITE(6,2000) MAXI,MAXJ,NSEG,NBC,NMTL
C* * * * *
C      INITIALIZE
C* * * * *
      ISEG=-1
      PI=3.1415927
      DO 110 J=1,80
      DO 100 I=1,25
      NCODE(I,J)=0
      AR(I,J)=0.
      AZ(I,J)=0.
      JMAX(I)=0
100  JMIN(I)=MAXI
      IMIN(J)=MAXJ
110  IMAX(J)=0
C* * * * *
C      LINE SEGMENT CARDS
C* * * * *
150  ISEG=ISEG+1
159  IF( ISEG.EQ.NSEG) GO TO 400
      READ(5,1001) I1,J1,R1,Z1,I2,J2,R2,Z2,I3,J3,R3,Z3,IPTION
      WRITE(6,2001) I1,J1,R1,Z1,I2,J2,R2,Z2,I3,J3,R3,Z3,IPTION
      IPTION=IPTION+1
      AR(I1,J1)=R1
      AZ(I1,J1)=Z1
      NCODE(I1,J1)=1
      CALL MNIMX(I1,J1)
      GO TO (150,200,200,300,300,200,200), IPTION
C* * * * *
C      GENERATE STRAIGHT LINES ON BOUNDARY
C* * * * *
200  DI= ABS(FLOAT(I2-I1))
      DJ= ABS(FLOAT(J2-J1))
      AR(I2,J2)=R2
      AZ(I2,J2)=Z2
      NCODE(I2,J2)=1
      CALL MNIMX(I2,J2)
      ISTRT=I1
      ISTOP=I2
      JSTRT=J1
      JSTOP=J2
      DIFF=MAX1(DI,DJ)
      ITER=DIFF-1.
      IINC=0
      JINC=0
      IF(I2.NE.I1) IINC=(I2-I1)/IABS(I2-I1)

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IF(J2.NE.J1) JINC=(J2-J1)/IABS(J2-J1)
KAPPA=1
IF(I2.NE.I1.AND.J2.NE.J1.AND.IPTION.NE.3) KAPPA=2
IF(KAPPA.EQ.2) DIFF=2.*DIFF
RINC=(R2-R1)/DIFF
ZINC=(Z2-Z1)/DIFF
WRITE(6,2002) DI,DJ,DIFF,RINC,ZINC,ITER,IINC,JINC,KAPPA
C
C
C
CHECK FOR INPUT ERROR

IF(KAPPA.NE.2.OR.DI.EQ.DJ) GO TO 210
WRITE(6,2003)
GO TO 150
C
C
C
INTERPOLATE
210 I=I1
J=J1
WRITE(6,2004)
DO 230 M=1,ITER
IF(ITER.EQ.0.AND.IPTION.EQ.2) GO TO 230
IF(ITER.EQ.0.AND.IPTION.EQ.6) GO TO 230
IF(ITER.EQ.0.AND.IPTION.EQ.7) GO TO 230
IF(KAPPA.EQ.2) GO TO 220
IOLD=I
I=I+IINC
JOLD=J
J=J+JINC
AR(I,J)=AR(IOLD,JOLD)+RINC
AZ(I,J)=AZ(IOLD,JOLD)+ZINC
WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
CALL MNIMX(I,J)
NCODE(I,J)=1
GO TO 230
220 CONTINUE
IF(I1.GT.I2.AND.IPTION.EQ.7) GO TO 221
IF(I1.LT.I2.AND.IPTION.EQ.6) GO TO 221
IOLD=I
I=I+IINC
AR(I,J)=AR(IOLD,J)+RINC
AZ(I,J)=AZ(IOLD,J)+ZINC
WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
NCODE(I,J)=1
CALL MNIMX(I,J)
JOLD=J
J=J+JINC
AR(I,J)=AR(I,JOLD)+RINC
AZ(I,J)=AZ(I,JOLD)+ZINC
NCODE(I,J)=1
WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
CALL MNIMX(I,J)
GO TO 230

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```

221 JOLD=J
    J=J+JINC
    AR(I,J)=AR(I,JOLD)+RINC
    AZ(I,J)=AZ(I,JOLD)+ZINC
    NCODE(I,J)=1
    WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
    CALL MNIMX(I,J)
    IOLD=I
    I=I+IINC
    AR(I,J)=AR(IOLD,J)+RINC
    AZ(I,J)=AZ(IOLD,J)+ZINC
    NCODE(I,J)=1
    WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
    CALL MNIMX(I,J)
230 CONTINUE
    IF(KAPPA.EQ.1) GO TO 150
    IF(I1.GT.I2.AND.IPTION.EQ.7) GO TO 231
    IF(I1.LT.I2.AND.IPTION.EQ.6) GO TO 231
    IOLD=I
    I=I+IINC
    AR(I,J)=AR(IOLD,J)+RINC
    AZ(I,J)=AZ(IOLD,J)+ZINC
    GO TO 232
231 CONTINUE
    JOLD=J
    J=J+JINC
    AR(I,J)=AR(I,JOLD)+RINC
    AZ(I,J)=AZ(I,JOLD)+ZINC
232 CONTINUE
    NCODE(I,J)=1
    WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
    CALL MNIMX(I,J)
    GO TO 150
C* * * * *
C    GENERATE CIRCULAR ARCS ON BOUNDARY
C* * * * *
300 AR(I2,J2)=R2
    AZ(I2,J2)=Z2
    NCODE(I2,J2)=1
    CALL MNIMX(I2,J2)
    IF(IPTION.EQ.5) GO TO 320
C
C    FIND CENTER OF CIRCLE
C
    AR(I3,J3)=R3
    AZ(I3,J3)=Z3
    NCODE(I3,J3)=1
    CALL MNIMX(I3,J3)
    SLAC=(Z2-Z1)/(R2-R1)
    SLBF=-1./SLAC
    SLCE=(Z3-Z2)/(R3-R2)
    SLD      AR(I,J)=AR(IOLD,J)+RINC
    AZ(I,J)=AZ(IOLD,J)+ZINC
    GO TO 232

```

```

231 CONTINUE
    JOLD=J
    J=J+JINC
    AR(I,J)=AR(I,JOLD)+RINC
    AZ(I,J)=AZ(I,JOLD)+ZINC
232 CONTINUE
    NCODE(I,J)=1
    WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
    CALL MNIMX(I,J)
    GO TO 150
C* * * * *
C    GENERATE CIRCULAR ARCS ON BOUNDARY
C* * * * *
300 AR(I2,J2)=R2
    AZ(I2,J2)=Z2
    NCODE(I2,J2) = 1
    CALL MNIMX(I2,J2)
    IF(IPTION.EQ.5) GO TO 320
C
C    FIND CENTER OF CIRCLE
C
    AR(I3,J3)=R3
    AZ(I3,J3)=Z3
    NCODE(I3,J3)=1
    CALL MNIMX(I3,J3)
    SLAC=(Z2-Z1)/(R2-R1)
    SLBF=-1./SLAC
    SLCE=(Z3-Z2)/(R3-R2)
    SLDF=-1./SLCE
C
C    CHECK FOR INPUT ERROR
C
    IF(ABS(SLAC-SLCE).GT..001) GO TO 310
    WRITE(6,2006) R1,Z1,R2,Z2,R3,Z3,SLAC,SLCE
    GO TO 150
310 R4=R1+(R2-R1)/2.
    Z4=Z1+(Z2-Z1)/2.
    R5=R2+(R3-R2)/2.
    Z5=Z2+(Z3-Z2)/2.
    BBF=Z4-SLBF*R4
    BDF=Z5-SLDF*R5
    RC=(BBF-BDF)/(SLDF-SLBF)
    ZC=SLBF*RC+BBF
    WRITE(6,2007) RC,ZC
    KAPPA=1
    GO TO 330
320 KAPPA=2
    RC=R3
    ZC=Z3
330 ISTRT=I1
    ISTOP=I2
    JSTRT=J1

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```

JSTP=J2
RSTRT=R1
RSTP=R2
ZSTRT=Z1
ZSTP=Z2
340 CALL ANGLE(RSTRT,ZSTRT,RC,ZC,ANG1)
CALL ANGLE(RSTP,ZSTP,RC,ZC,ANG2)
IF(ANG2.LE.ANG1) ANG2=2.0*PI+ANG2

C
C   FIND ANGULAR INCREMENT
C
DI= ABS(FLOAT(ISTP-ISTRT))
DJ= ABS(FLOAT(JSTP-JSTRT))
IINC=0
JINC=0
IF(ISTRT.NE.ISTP) IINC=(ISTP-ISTRT)/IABS(ISTP-ISTRT)
IF(JSTRT.NE.JSTP) JINC=(JSTP-JSTRT)/IABS(JSTP-JSTRT)
LAMDA=1
IF(IINC.NE.0.AND.JINC.NE.0) LAMDA=2
DIFF=MAX1(DI,DJ)
ITER=DIFF-1.
IF(LAMDA.EQ.2) DIFF=2.*DIFF
DELPHI=(ANG2-ANG1)/DIFF
WRITE(6,2008) ANG1,ANG2,DIFF,DELPHI

C
C   CHECK FOR INPUT ERROR
C
IF(LAMDA.NE.2.OR.DI.EQ.DJ) GO TO 350
WRITE(6,2003)
GO TO 150
350 IO=ISTRT
JO=JSTRT
WRITE(6,2004)

C
C   INTERPOLATE
C
NPT=IABS(I2-I1)+IABS(J2-J1)-1
DO 380 M=1,ITER
359 IF(LAMDA.EQ.2) GO TO 360
I=IO+IINC
J=JO+JINC
CALL MNIMX(I,J)
NCODE(I,J)=1
CALL CIRCLE(ANG1,DELPHI,RSTRT,ZSTRT,RC,ZC,I,J)
WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
GO TO 370
360 I=IO+IINC
J=JO
NCODE(I,J)=1
CALL MNIMX(I,J)
CALL CIRCLE(ANG1,DELPHI,RSTRT,ZSTRT,RC,ZC,I,J)
WRITE(6,2005) I,J,AR(I,J),AZ(I,J)

```

```

      J=JO+JINC
      NCODE(I,J)=1
      CALL MNIMX(I,J)
      CALL CIRCLE(ANG1,DELPHI,RSTRT,ZSTRT,RC,ZC,I,J)
      WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
370  IO=I
380  JO=J
      IF(LAMDA.NE.2) GO TO 390
      I=IO+IINC
      NCODE(I,J)=1
      CALL MNIMX(I,J)
      CALL CIRCLE(ANG1,DELPHI,RSTRT,ZSTRT,RC,ZC,I,J)
      WRITE(6,2005) I,J,AR(I,J),AZ(I,J)
390  IF(KAPPA.EQ.2) GO TO 150
      ISTRT=I2
      ISTOP=I3
      JSTRT=J2
      JSTOP=J3
      RSTRT=R2
      RSTOP=R3
      ZSTRT=Z2
      ZSTOP=Z3
      KAPPA=2
399  GO TO 340
C* * * * *
C    CALCULATE COORDINATES OF INTERIOR POINTS
C* * * * *
400  IF(MAXJ.LE.2) GO TO 430
      J2=MAXJ-1
      DO 420 N=1,500
        RESID=0.
        DO 410 J=2,J2
          I1=IMIN(J)+1
          I2=IMAX(J)-1
          DO 410 I=I1,I2
            IF(NCODE(I,J).EQ.1) GO TO 410
            DR=(AR(I+1,J)+AR(I-1,J)+AR(I,J+1)+AR(I,J-1))/4.-AR(I,J)
            DZ=(AZ(I+1,J)+AZ(I-1,J)+AZ(I,J+1)+AZ(I,J-1))/4.-AZ(I,J)
            RESID=RESID+ABS(DR)+ABS(DZ)
            AR(I,J)=AR(I,J)+1.8*DR
            AZ(I,J)=AZ(I,J)+1.8*DZ
410  CONTINUE
          IF(N.EQ.1) RES1=RESID
          IF(N.EQ.1.AND.RESID.EQ.0.)GO TO 430
          IF(RESID/RES1.LT.1.E-5) GO TO 430
420  CONTINUE
430  WRITE(6,2009) N
C* * * * *
      CALL POINTS
C* * * * *
1000 FORMAT (5I5)
1001 FORMAT (3(2I3,2F8.3),I5)

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2000 FORMAT (30H1 MESH GENERATION INFORMATION//
1 41H0 MAXIMUM VALUE OF I IN THE MESH-----I3/
2 41H0 MAXIMUM VALUE OF J IN THE MESH-----I3/
3 41H0 NUMBER OF LINE SEGMENT CARDS-----I3/
4 41H0 NUMBER OF BOUNDARY CONDITION CARDS----I3/
5 41H0 NUMBER OF MATERIAL BLOCK CARDS-----I3///)
2001 FORMAT (//88H INPUT I1 J1 R1 Z1 I2 J2 R2 Z
12 I3 J3 R3 Z3 IPTION/8X,3(2I4,2F8.4),I6)
2002 FORMAT (5H DI=F4.0,5H DJ=F4.0,7H DIFF=F4.0,7H RINC=F8.3,7H ZI
1NC=F8.3,7H ITER=I3,7H IINC=I3,7H JINC=I3,8H KAPPA=I1)
2003 FORMAT(1X,38H**BAD INPUT--THIS LINE IS NOT DIAGONAL)
2004 FORMAT (30H I J AR AZ)
2005 FORMAT (2I5,2F11.6)
2006 FORMAT (51H ** BAD INPUT - THESE POINTS DO NOT DEFINE A CIRCLE,/,
13X,6F12.4,10X,2E20.8)
2007 FORMAT(19H CENTER COORDINATE,(F11.6,1X,F11.6,1X))
2008 FORMAT (7H ANGL=F9.6,7H ANG2=F9.6,7H DIFF=F3.0,9H DELPHI=F9.6)
2009 FORMAT (//30H COORDINATES CALCULATED AFTER I3,11H ITERATIONS)
RETURN
END
SUBROUTINE MNIMX(I,J)
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
IF(J.LT.JMIN(I)) JMIN(I)=J
IF(J.GT.JMAX(I)) JMAX(I)=J
IF(I.LT.IMIN(J)) IMIN(J)=I
IF(I.GT.IMAX(J)) IMAX(J)=I
RETURN
END
SUBROUTINE ADINA(NFACE,FTHETA)
INTEGER CODE
COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
1NPNUM(25,80),T(1000),XT(1000)
COMMON/ARG/RRR(5),ZZZ(5),RR(4),ZZ(4),S(15,15),P(15),TT(6),
1H(6,15),CRZ(6,6),XI(10),ANGLE(4),SIG(18),EPS(18),N
COMMON/ELDATA/BETA(1000),EPR(1000),PR(200),SH(200),IX(1000,5),
1IP(200),JP(200),IS(200),JS(200),ALPHA(1000),IT(200),JT(200),
2ST(200),INP(1000),JNP(1000)
COMMON/BASIC/ACELZ,ANGVEL,ANGACC,TREF,VOL,NUMNP,NUMEL,NUMPC,NUMSC,
1NUMST
COMMON/NXMESH/THETAN(4),NST(4),NUMS(4,5),NPC(8,8)
DIMENSION NPG(25,80,9),FTHETA(9),NCOD(8),NEL(8),ID(6)
COMMON/ANS1/NUMELS(4),NUMNPS(4)
COMMON/NXDATA/NTP,NTYPS,NTS,NTOTS
COMMON/NONAXI/S1(30,30),P1(30),THETA,BS1(6,30)
COMMON/SOLVE/X(4428),Y(4428),TEM(4428),NUMTC,MBAND
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
COMMON/CONVRG/IDONE
COMMON/PLANE/NPP
COMMON/RESULT/BS(6,15),D(6,6),C(6,6),AR,BB(6,9),CNS(6,6)
COMMON/MATP/RO(6),E(12,16,6),EE(16),AOFTS(6)
COMMON/TOTAL/NELN
DATA NPG/18000*0/

```

```

      NI=NST(NTP)
C  LOOP ON # OF SEGMENTS OF TYPE NTP
      DO 500 I=1,NI
      DO 200 J=1,NUMNP
      NFL=NUMS(NTP,I)
      NFR=NFL+1
      IP1=INP(J)
      JP1=JNP(J)
      NF=NFL
      DO 200 K=1,2
      NC=CODE(J)+1
      IF(NPG(IP1,JP1,NF).NE.0)GO TO 200
      NPG(IP1,JP1,NF)=IP1+(JP1-1)*25+NF*200
      DO 10 II=1,8
10    ID(II)=0
      IF(NC.EQ.3.OR.NC.EQ.4.OR.NC.EQ.7.OR.NC.EQ.8) ID(1)=1
      IF(NF.EQ.1) ID(3)=1
      IF(NF.EQ.NTOTS+1) ID(2)=1
      IF(R(J).EQ.0.0) ID(2)=1
      IF(R(J).EQ.0.0) ID(3)=1
C
C    WRITE NODAL DATA ON FILE 2
C
      WRITE(2,100)NPG(IP1,JP1,NF),(ID(KK),KK=1,6),Z(J),R(J),FTHETA(NF)
100  FORMAT("X",I4,1X,I4,5I5,3F10.4,4X,"0")
200  NF=NFR
      DO 350 J=1,NUMEL
      NF=NUMS(NTP,I)
      I1=IX(J,1)
      I2=IX(J,2)
      I3=IX(J,3)
      I4=IX(J,4)
      IP1=INP(I1)
      JP1=JNP(I1)
      NEL(1)=NPG(IP1,JP1,NFL)
      IF(IP1.EQ.1)NEL(1)=NPG(IP1,JP1,1)
      NEL(4)=NPG(IP1,JP1,NFR)
      IP1=INP(I2)
      JP1=JNP(I2)
      NEL(2)=NPG(IP1,JP1,NFL)
      NEL(3)=NPG(IP1,JP1,NFR)
      IP1=INP(I4)
      JP1=JNP(I4)
      NEL(5)=NPG(IP1,JP1,NFL)
      IF(IP1.EQ.1)NEL(5)=NPG(IP1,JP1,1)
      NEL(8)=NPG(IP1,JP1,NFR)
      IP1=INP(I3)
      JP1=JNP(I3)
      NEL(6)=NPG(IP1,JP1,NFL)
      NEL(7)=NPG(IP1,JP1,NFR)
      NELN=NELN+1
      NZ=0

```



```

      N8=8
      WRITE(3,300)NELN,N8,N8,NZ,IX(J,5),NELN,NZ,NZ
300  FORMAT(8I5,F10.0)
      WRITE(3,301) (NEL(K),K=1,8)
301  FORMAT(8I5)
C
C      WRITE MATERIAL AXES DATA ON FILE 4
C
      NPI=NEL(1)+7000
      NPJ=NEL(1)+8000
      NPK=NEL(1)+9000
      WRITE(4,302) NELN,NPI,NPJ,NPK
302  FORMAT(4I5)
C
C      WRITE NODAL POINTS FOR MATERIAL AXES
C
      FTRAD=FTHETA(NF)/57.29578
      CA=COS(ALPHA(J))
      CB=COS(BETA(J))
      SA=SIN(ALPHA(J))
      SB=SIN(BETA(J))
      CF=COS(FTRAD)
      SF=SIN(FTRAD)
      XPI=0.0
      YPI=0.0
      ZPI=0.0
      XPJ=CA*CB
      YPJ=CA*SB*CF+SA*SF
      ZPJ=CA*SB*SF-SA*CF
      XPK=SA*CB
      YPK=SA*SB*CF-CA*SF
      ZPK=SA*SB*SF+CA*CF
      WRITE(7,303)NPI,NZ,NZ,NZ,NZ,NZ,NZ,NZ,XPI,YPI,ZPI
      WRITE(7,303)NPJ,NZ,NZ,NZ,NZ,NZ,NZ,NZ,XPJ,YPJ,ZPJ
      WRITE(7,303)NPK,NZ,NZ,NZ,NZ,NZ,NZ,NZ,XPK,YPK,ZPK
303  FORMAT(1X,I4,1X,I4,5I5,3F10.4,4X,"0")
350  CONTINUE
      DO 500 L=1,NUMPC
      IP1=INP(IP(L))
      JP1=JNP(IP(L))
      IP2=INP(JP(L))
      JP2=JNP(JP(L))
      NEL(1)=NPG(IP1,JP1,NFL)
      NEL(2)=NPG(IP2,JP2,NFL)
      NEL(3)=NPG(IP2,JP2,NFR)
      NEL(4)=NPG(IP1,JP1,NFR)
      NCUR=1
      WRITE(1,400)NCUR,(NEL(K),K=1,4)
      WRITE(1,401) PR(L),PR(L),PR(L),PR(L)
400  FORMAT(9I5)
401  FORMAT(5F10.0,I5)
500  CONTINUE

```



```

END
FUNCTION NODE(I,J)
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
NODE=0
DO 100 JJ=1,J
  NSTART=IMIN(JJ)
  NSTOP=IMAX(JJ)
  DO 100 II=NSTART,NSTOP
    NODE=NODE+1
    IF(JJ.EQ.J.AND.II.EQ.I) RETURN
100 CONTINUE
  RETURN
END
SUBROUTINE POINTS
INTEGER CODE
COMMON/BASIC/ACELZ,ANGVEL,ANGACC,TREF,VOL,NUMNP,NUMEL,NUMPC,NUMSC,
1NUMST
COMMON/MATP/RO(6),E(12,16,6),EE(16),AOFTS(6)
COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
1INPNUM(25,80),T(1000),XT(1000)
COMMON/ELDATA/BETA(1000),EPR(1000),PR(200),SH(200),IX(1000,5),
1IP(200),JP(200),IS(200),JS(200),ALPHA(1000),IT(200),JT(200),
2ST(200),INP(1000),JNP(1000)
COMMON/SOLVE/X(4428),Y(4428),TEM(4428),NUMTC,MBAND
COMMON/TD/IMIN(100),IMAX(100),JMIN(25),JMAX(25),MAXI,MAXJ,NMTL,NBC
COMMON/PLANE/NPP
DIMENSION AR(25,80),AZ(25,80),MATRIL(100,5),BLKANG(100),BLKALF(1
100)
DIMENSION IBNG(100),NBNG(100)
EQUIVALENCE (R(1),AR),(Z(1),AZ)
C ESTABLISH NODAL POINT INFORMATION
C* * * * *
NEL=0
NODSUM=0
DO 100 J=1,MAXJ
  NSTART=IMIN(J)
  NSTOP=IMAX(J)
  DO 100 I=NSTART,NSTOP
100 NODSUM=NODSUM+1
  NELSUM=0
  JJMAX=MAXJ-1
  DO 110 JJ=1,JJMAX
    NSTOP=MIN0(IMAX(JJ),IMAX(JJ+1))-1
    NSTART=MAX0(IMIN(JJ),IMIN(JJ+1))
    DO 110 II=NSTART,NSTOP
110 NELSUM=NELSUM+1
  NUMNP=NODSUM
  NUMEL=NELSUM
  DO 120 J=1,MAXJ
    NSTART=IMIN(J)
    NSTOP=IMAX(J)
    DO 120 I=NSTART,NSTOP

```

```

      NPNUM(I,J)=NODE(I,J)
      NP=NPNUM(I,J)
      INP(NP)=I
      JNP(NP)=J
      R(NP)=AR(I,J)
120  Z(NP)=AZ(I,J)
C* * * * *
C      READ AND ASSIGN BOUNDARY CONDITIONS
C* * * * *
C      INITIALIZE
C* * * * *
      DO 130 I=1,NUMNP
      CODE(I)=0
      IF(R(I).EQ.0..AND.NPP.EQ.0) CODE(I)=1.
      XR(I)=0.
      XZ(I)=0.
      XT(I)=0.0
130  T(I)=0.
      IF(NBC.EQ.0) GO TO 210
      DO 200 IBCON=1,NBC
      READ(5,1002) I1,I2,J1,J2,ICN,RCON,ZCON,TCON
      DO 200 I=I1,I2
      DO 200 J=J1,J2
      NP=NPNUM(I,J)
      CODE(NP)=ICN
      XR(NP)=RCON
      XT(NP)=TCON
200  XZ(NP)=ZCON
210  MPRINT=0
      DO 230 J=1,MAXJ
      NSTART=IMIN(J)
      NSTOP=IMAX(J)
      DO 230 I=NSTART,NSTOP
      NP=NPNUM(I,J)
      IF(MPRINT.NE.0) GO TO 220
      WRITE(6,2000)
      MPRINT=59
220  MPRINT=MPRINT-1
230  WRITE(6,2001) I,J,NP,CODE(NP),R(NP),Z(NP),XR(NP),XZ(NP),XT(NP)
C* * * * *
C      ASSIGN MATERIALS IN BLOCKS
C* * * * *
      DO 300 M1=1,NUMEL
300  IX(M1,5)=0
      DO 310 IMTL=1,NMTL
      READ (5,1000) MTL,(MATRIL(IMTL,IM),IM=2,5),BLKANG(IMTL),BLKALF(IMT
1L),IBNG(IMTL),NBNG(IMTL)
310  MATRIL(IMTL,1)=MTL
C* * * * *
C      ESTABLISH ELEMENT INFORMATION
C* * * * *
      JJMAX=MAXJ-1

```

```

N=0
MTL=1
KTL=1
DO 440 JJ=1,JJMAX
NSTOP=MIN0(IMAX(JJ),IMAX(JJ+1))-1
NSTART=MAX0(IMIN(JJ),IMIN(JJ+1))
DO 440 II=NSTART,NSTOP
NEL=NEL+1
DO 400 IMTL=1,NMTL
IF(II.LT.MATRIL(IMTL,2)) GO TO 400
IF(II.GE.MATRIL(IMTL,3)) GO TO 400
IF(JJ.LT.MATRIL(IMTL,4)) GO TO 400
IF(JJ.MR(T)GOO KT MATM(L) 4CIE KQ.KTL) GOO
G4 0(II.Q.NSTAXI.NE.NSTOP) GO TO 440 K=KT TA
M=NEL+1
IANG=ICNG
NANG=NCNG
GO TO 421
420 I=NPNUM(II,JJ)
=
=K K=(,+
IX(M,) I2
I)=K
X,L I)
ANGFIBE(KT
N *INTERRUPTED*
get,diab
*TERMINATED*
/diab,p=yes,s=41
#PAGES= 53

```

```

N=0
MTL=1
KTL=1
DO 440 JJ=1,JJMAX
NSTOP=MIN0(IMAX(JJ),IMAX(JJ+1))-1
NSTART=MAX0(IMIN(JJ),IMIN(JJ+1))
DO 440 II=NSTART,NSTOP
NEL=NEL+1
DO 400 IMTL=1,NMTL
IF(II.LT.MATRIL(IMTL,2)) GO TO 400
IF(II.GE.MATRIL(IMTL,3)) GO TO 400
IF(JJ.LT.MATRIL(IMTL,4)) GO TO 400
IF(JJ.GE.MATRIL(IMTL,5)) GO TO 400
KAT=IMTL
MAT=MATRIL(IMTL,1)
400 CONTINUE
IF(KAT.EQ.KTL) GO TO 410
KTL=KAT
MTL=MAT
GO TO 420
410 IF(II.EQ.NSTART) GO TO 420
IF(JJ.NE.JJMAX.OR.II.NE.NSTOP) GO TO 440
M=NEL+1
IANG=ICNG
NANG=NCNG
GO TO 421
420 I=NPNUM(II,JJ)
J=I+1
K=NPNUM(II+1,JJ+1)
L=K-1
M=NEL
IX(M,1)=I
IX(M,2)=J
IX(M,3)=K
IX(M,4)=L
IX(M,5)=MTL
BETA(M)=BLKANG(KTL)
ALPHA(M)=BLKALF(KTL)
IANG=ICNG
NANG=NCNG
ICNG=IBNG(KTL)
NCNG=NBNG(KTL)
421 NC=2
430 N=N+1
IF(M.LE.N) GO TO 440
IX(N,1)=IX(N-1,1)+1
IX(N,2)=IX(N-1,2)+1
IX(N,3)=IX(N-1,3)+1
IX(N,4)=IX(N-1,4)+1
IX(N,5)=IX(N-1,5)
BETA(N)=BETA(N-1)
IF(IANG.EQ.1) GO TO 442

```

```

        ALPHA(N)=ALPHA(N-1)
        GO TO 443
442  CONTINUE
        IF(NC.GT.NANG) GO TO 444
        ALPHA(N)=ALPHA(N-1)
        GO TO 443
444  NC=1
        ALPHA(N)=-ALPHA(N-1)
443  CONTINUE
        NC=NC+1
        IF(M.GT.N) GO TO 430
440  CONTINUE
        IF(NUMNP.GT.2000) WRITE(6,2002)
C* * * * *
C    SET NODAL POINT TEMPERATURE TO REFERENCE TEMPERATURE
C* * * * *
        IF(NUMTC.NE.0) RETURN
        DO 500 N=1,NUMNP
          500  T(N)=TREF
          1000  FORMAT (5I5,2F10.0,2I5)
          1002  FORMAT(4I5,I10,3F10.0)
          2000  FORMAT (128H1      I      J      NP      TYPE      R-ORDINATE      Z-ORDINA
                1TE R LOAD OR DISPLACEMENT Z LOAD OR DISPLACEMENT T LOAD OR DISP
                2LACEMENT)
          2001  FORMAT (2I5,I6,I12,F13.6,F14.6,E26.7,E24.7,E24.7)
          2002  FORMAT (35H  BAD INPUT - TOO MANY NODAL POINTS)
          RETURN
        END
        SUBROUTINE TEMP(R,Z,T)
        COMMON/SOLVE/X(4428),Y(4428),TEM(4428),NUMTC,MBAND
        DIMENSION SMALL(20),ISM(20)
C* * * * *
C    INITIALIZE
C* * * * *
        J=1
        JMAX=16
        IF(NUMTC.LT.JMAX) JMAX=NUMTC
        DO 10 I=1,JMAX
          SMALL(I)=0.
        10  ISM(I)=0
C* * * * *
C    FIND THE JMAX CLOSEST POINTS
C* * * * *
        DO 50 I=1,NUMTC
          DSQ=(X(I)-R)**2+(Y(I)-Z)**2
          IF(DSQ.GT.1E-4) GO TO 20
          T=TEM(I)
          RETURN
        20  IF(I.EQ.1) SMALL(1)=DSQ
          IF(I.EQ.1) ISM(1)=1
          IF(I.EQ.1) GO TO 50
          IF(SMALL(J).LE.DSQ.AND.J.LT.JMAX) SMALL(J+1)=DSQ

```

```

      IF(SMALL(J).LE.DSQ.AND.J.LT.JMAX) ISM(J+1)=I
      IF(SMALL(J).LE.DSQ) GO TO 40
      DO 30 K=1,J
      JB=J-K +1
      IF(JB.EQ.0) GO TO 40
      SMALL(JB+1)=SMALL(JB)
      ISM(JB+1)=ISM(JB)
      SMALL(JB)=DSQ
      ISM(JB)=I
      IF(JB.EQ.1) GO TO 40
      IF(SMALL(JB-1).LE.DSQ) GO TO 40
30  CONTINUE
40  IF(J.LT.JMAX) J=J+1
50  CONTINUE
C* * * * *
C    FIND THE THIRD TEMPERATURE POINT BY AREA TEST
C* * * * *
      JCHK=JMAX-2
      J=0
      I1=ISM(1)
      I2=ISM(2)
60  I3=ISM(J+3)
      AREA=.50*(Y(I1)*X(I3)-Y(I3)*X(I1)+Y(I3)*X(I2)-Y(I2)*X(I3)+
1     Y(I2)*X(I1)-Y(I1)*X(I2))
      D1=(X(I2)-X(I1))**2+(Y(I2)-Y(I1))**2
C    IF D1 IS APPROXIMATELY 0. IT IS ASSUMED THAT THERE EXISTS A
C    DUPLICATION OF INPUT
      IF(D1.GT..1E-3) GO TO 70
      I2=I3
      J=J+1
      GO TO 60
70  IF(AREA**2.GT..1*D1*SMALL(1)) GO TO 80
      J=J+1
      IF(J.LT.JCHK) GO TO 60
      WRITE(6,2000) I1,I2,I3,J
      T=TEM(I1)
      RETURN
C* * * * *
C    FIND TEMPERATURE INTERCEPT
C* * * * *
80  DETA=Y(I1)*(TEM(I3)-TEM(I2))+Y(I2)*(TEM(I1)-TEM(I3))
1     +Y(I3)*(TEM(I2)-TEM(I1))
      DETB=X(I1)*(TEM(I2)-TEM(I3))+X(I2)*(TEM(I3)-TEM(I1))
1     +X(I3)*(TEM(I1)-TEM(I2))
      DETC=TEM(I1)*(X(I2)*Y(I3)-X(I3)*Y(I2))+TEM(I2)*(X(I3)*Y(I1)-X(I1)*
1     Y(I3))+TEM(I3)*(X(I1)*Y(I2)-X(I2)*Y(I1))
      T=(DETA*R+DETB*Z+DETC)/(2.*AREA)
2000 FORMAT (28H ERROR IN TEMPERATURE INPUT,5H I1=I4,5H I2=I4,
15H I3=I4,4H J=I4)
      RETURN
      END
      SUBROUTINE TEM2(NUMNP)

```

```

      INTEGER CODE
      COMMON/NPDATA/R(1000),CODE(1000),XR(1000),Z(1000),XZ(1000),
1NPNUM(25,80),T(1000),XT(1000)
      READ(5,1000) TCONST
      DO 100 N=1,NUMNP
100   T(N)=TCONST
1000  FORMAT(F10.0)
      RETURN
      END
      END
N

```


APPENDIX C

Listing of File ADI,
the Input Cards for ADINA Program

X 201	1	1	1	0	0	0	7.9950	0.0000	0.0000	0	ADNPD
X 401	1	1	1	0	0	0	7.9950	0.0000	18.8000	0	
X 202	1	1	1	0	0	0	7.9950	.2363	0.0000	0	
X 402	1	1	1	0	0	0	7.9950	.2363	18.8000	0	
X 203	1	1	1	0	0	0	7.9950	.4725	0.0000	0	
X 403	1	1	1	0	0	0	7.9950	.4725	18.8000	0	
X 204	1	1	1	0	0	0	7.9950	.5050	0.0000	0	
X 404	1	1	1	0	0	0	7.9950	.5050	18.8000	0	
X 205	1	1	1	0	0	0	7.9950	.5375	0.0000	0	
X 405	1	1	1	0	0	0	7.9950	.5375	18.8000	0	
X 206	1	1	1	0	0	0	8.0218	1.0467	0.0000	0	
X 406	1	1	1	0	0	0	8.0218	1.0467	18.8000	0	
X 207	0	0	1	0	0	0	8.0486	1.5558	0.0000	0	
X 407	0	0	1	0	0	0	8.0486	1.5558	18.8000	0	
X 208	0	0	1	0	0	0	8.0754	2.0650	0.0000	0	
X 408	0	0	1	0	0	0	8.0754	2.0650	18.8000	0	
X 226	0	1	1	0	0	0	9.3024	0.0000	0.0000	0	
X 426	0	1	1	0	0	0	9.3024	0.0000	18.8000	0	
X 227	0	0	1	0	0	0	9.3234	.2362	0.0000	0	
X 427	0	0	1	0	0	0	9.3234	.2362	18.8000	0	
X 228	0	0	1	0	0	0	9.3024	.4725	0.0000	0	
X 428	0	0	1	0	0	0	9.3024	.4725	18.8000	0	
X 229	0	0	1	0	0	0	9.3230	.5091	0.0000	0	
X 429	0	0	1	0	0	0	9.3230	.5091	18.8000	0	
X 230	0	0	1	0	0	0	9.3024	.5375	0.0000	0	
X 430	0	0	1	0	0	0	9.3024	.5375	18.8000	0	
X 231	0	0	1	0	0	0	9.2469	1.0393	0.0000	0	
X 431	0	0	1	0	0	0	9.2469	1.0393	18.8000	0	
X 232	0	0	1	0	0	0	9.0533	1.5509	0.0000	0	
X 432	0	0	1	0	0	0	9.0533	1.5509	18.8000	0	
X 233	0	0	1	0	0	0	8.8254	2.0650	0.0000	0	
X 433	0	0	1	0	0	0	8.8254	2.0650	18.8000	0	
X 251	0	1	1	0	0	0	10.6098	0.0000	0.0000	0	
X 451	0	1	1	0	0	0	10.6098	0.0000	18.8000	0	
X 252	0	0	1	0	0	0	10.6944	.2363	0.0000	0	
X 452	0	0	1	0	0	0	10.6944	.2363	18.8000	0	
X 253	0	0	1	0	0	0	10.6098	.4725	0.0000	0	
X 453	0	0	1	0	0	0	10.6098	.4725	18.8000	0	
X 254	0	0	1	0	0	0	10.6919	.5214	0.0000	0	
X 454	0	0	1	0	0	0	10.6919	.5214	18.8000	0	
X 255	0	0	1	0	0	0	10.6098	.5375	0.0000	0	
X 455	0	0	1	0	0	0	10.6098	.5375	18.8000	0	
X 256	0	0	1	0	0	0	10.6098	1.0222	0.0000	0	
X 456	0	0	1	0	0	0	10.6098	1.0222	18.8000	0	
X 257	0	0	1	0	0	0	10.0926	1.5436	0.0000	0	
X 457	0	0	1	0	0	0	10.0926	1.5436	18.8000	0	
X 258	0	0	1	0	0	0	9.5754	2.0650	0.0000	0	
X 458	0	0	1	0	0	0	9.5754	2.0650	18.8000	0	
X 276	0	1	1	0	0	0	12.2166	0.0000	0.0000	0	
X 476	0	1	1	0	0	0	12.2166	0.0000	18.8000	0	
X 277	0	0	1	0	0	0	12.2338	.2362	0.0000	0	
X 477	0	0	1	0	0	0	12.2338	.2362	18.8000	0	
X 278	0	0	1	0	0	0	12.2300	.4725	0.0000	0	
X 478	0	0	1	0	0	0	12.2300	.4725	18.8000	0	
X 279	0	0	1	0	0	0	12.2255	.5666	0.0000	0	
X 479	0	0	1	0	0	0	12.2255	.5666	18.8000	0	
X 280	0	0	1	0	0	0	12.2211	.6607	0.0000	0	
X 480	0	0	1	0	0	0	12.2211	.6607	18.8000	0	
X 281	0	0	1	0	0	0	12.2166	.7548	0.0000	0	

X 481	0	0	1	0	0	0	12.2166	.7548	18.8000	0
X 301	0	1	1	0	0	0	13.8234	0.0000	0.0000	0
X 501	0	1	1	0	0	0	13.8234	0.0000	18.8000	0
X 302	0	0	1	0	0	0	13.7950	.2363	0.0000	0
X 502	0	0	1	0	0	0	13.7950	.2363	18.8000	0
X 303	0	0	1	0	0	0	13.8234	.4725	0.0000	0
X 503	0	0	1	0	0	0	13.8234	.4725	18.8000	0
X 304	0	0	1	0	0	0	13.8234	.4775	0.0000	0
X 504	0	0	1	0	0	0	13.8234	.4775	18.8000	0
X 305	0	0	1	0	0	0	13.8234	.4825	0.0000	0
X 505	0	0	1	0	0	0	13.8234	.4825	18.8000	0
X 306	0	0	1	0	0	0	13.8234	.4875	0.0000	0
X 506	0	0	1	0	0	0	13.8234	.4875	18.8000	0
X 326	0	1	1	0	0	0	15.3068	0.0000	0.0000	0
X 526	0	1	1	0	0	0	15.3068	0.0000	18.8000	0
X 327	0	0	1	0	0	0	15.2992	.2362	0.0000	0
X 527	0	0	1	0	0	0	15.2992	.2362	18.8000	0
X 328	0	0	1	0	0	0	15.3068	.4725	0.0000	0
X 528	0	0	1	0	0	0	15.3068	.4725	18.8000	0
X 351	0	1	1	0	0	0	16.7903	0.0000	0.0000	0
X 551	0	1	1	0	0	0	16.7903	0.0000	18.8000	0
X 352	0	0	1	0	0	0	16.7883	.2362	0.0000	0
X 552	0	0	1	0	0	0	16.7883	.2362	18.8000	0
X 353	0	0	1	0	0	0	16.7903	.4725	0.0000	0
X 553	0	0	1	0	0	0	16.7903	.4725	18.8000	0
X 376	0	1	1	0	0	0	18.2737	0.0000	0.0000	0
X 576	0	1	1	0	0	0	18.2737	0.0000	18.8000	0
X 377	0	0	1	0	0	0	18.2737	.2363	0.0000	0
X 577	0	0	1	0	0	0	18.2737	.2363	18.8000	0
X 378	0	0	1	0	0	0	18.2737	.4725	0.0000	0
X 578	0	0	1	0	0	0	18.2737	.4725	18.8000	0
X 601	0	0	1	0	0	0	7.9950	0.0000	37.6000	0
X 602	0	0	1	0	0	0	7.9950	.2363	37.6000	0
X 603	0	0	1	0	0	0	7.9950	.4725	37.6000	0
X 604	0	0	1	0	0	0	7.9950	.5050	37.6000	0
X 605	0	0	1	0	0	0	7.9950	.5375	37.6000	0
X 606	0	0	1	0	0	0	8.0218	1.0467	37.6000	0
X 607	0	0	1	0	0	0	8.0486	1.5558	37.6000	0
X 608	0	0	1	0	0	0	8.0754	2.0650	37.6000	0
X 626	0	0	1	0	0	0	9.3024	0.0000	37.6000	0
X 627	0	0	1	0	0	0	9.3234	.2362	37.6000	0
X 628	0	0	1	0	0	0	9.3024	.4725	37.6000	0
X 629	0	0	1	0	0	0	9.3230	.5091	37.6000	0
X 630	0	0	1	0	0	0	9.3024	.5375	37.6000	0
X 631	0	0	1	0	0	0	9.2469	1.0393	37.6000	0
X 632	0	0	1	0	0	0	9.0533	1.5509	37.6000	0
X 633	0	0	1	0	0	0	8.8254	2.0650	37.6000	0
X 651	0	0	1	0	0	0	10.6098	0.0000	37.6000	0
X 652	0	0	1	0	0	0	10.6944	.2363	37.6000	0
X 653	0	0	1	0	0	0	10.6098	.4725	37.6000	0
X 654	0	0	1	0	0	0	10.6919	.5214	37.6000	0
X 655	0	0	1	0	0	0	10.6098	.5375	37.6000	0
X 656	0	0	1	0	0	0	10.6098	1.0222	37.6000	0
X 657	0	0	1	0	0	0	10.0926	1.5436	37.6000	0
X 658	0	0	1	0	0	0	9.5754	2.0650	37.6000	0
X 676	0	0	1	0	0	0	12.2166	0.0000	37.6000	0
X 677	0	0	1	0	0	0	12.2338	.2362	37.6000	0
X 678	0	0	1	0	0	0	12.2300	.4725	37.6000	0
X 679	0	0	1	0	0	0	12.2255	.5666	37.6000	0
X 680	0	0	1	0	0	0	12.2211	.6607	37.6000	0

X 681	0	0	1	0	0	0	12.2166	.7548	37.6000	0
X 701	0	0	1	0	0	0	13.8234	0.0000	37.6000	0
X 702	0	0	1	0	0	0	13.7950	.2363	37.6000	0
X 703	0	0	1	0	0	0	13.8234	.4725	37.6000	0
X 704	0	0	1	0	0	0	13.8234	.4775	37.6000	0
X 705	0	0	1	0	0	0	13.8234	.4825	37.6000	0
X 706	0	0	1	0	0	0	13.8234	.4875	37.6000	0
X 726	0	0	1	0	0	0	15.3068	0.0000	37.6000	0
X 727	0	0	1	0	0	0	15.2992	.2362	37.6000	0
X 728	0	0	1	0	0	0	15.3068	.4725	37.6000	0
X 751	0	0	1	0	0	0	16.7903	0.0000	37.6000	0
X 752	0	0	1	0	0	0	16.7883	.2362	37.6000	0
X 753	0	0	1	0	0	0	16.7903	.4725	37.6000	0
X 776	0	0	1	0	0	0	18.2737	0.0000	37.6000	0
X 777	0	0	1	0	0	0	18.2737	.2363	37.6000	0
X 778	0	0	1	0	0	0	18.2737	.4725	37.6000	0
X 801	0	0	1	0	0	0	7.9950	0.0000	56.4000	0
X 802	0	0	1	0	0	0	7.9950	.2363	56.4000	0
X 803	0	0	1	0	0	0	7.9950	.4725	56.4000	0
X 804	0	0	1	0	0	0	7.9950	.5050	56.4000	0
X 805	0	0	1	0	0	0	7.9950	.5375	56.4000	0
X 806	0	0	1	0	0	0	8.0218	1.0467	56.4000	0
X 807	0	0	1	0	0	0	8.0486	1.5558	56.4000	0
X 808	0	0	1	0	0	0	8.0754	2.0650	56.4000	0
X 826	0	0	1	0	0	0	9.3024	0.0000	56.4000	0
X 827	0	0	1	0	0	0	9.3234	.2362	56.4000	0
X 828	0	0	1	0	0	0	9.3024	.4725	56.4000	0
X 829	0	0	1	0	0	0	9.3230	.5091	56.4000	0
X 830	0	0	1	0	0	0	9.3024	.5375	56.4000	0
X 831	0	0	1	0	0	0	9.2469	1.0393	56.4000	0
X 832	0	0	1	0	0	0	9.0533	1.5509	56.4000	0
X 833	0	0	1	0	0	0	8.8254	2.0650	56.4000	0
X 851	0	0	1	0	0	0	10.6098	0.0000	56.4000	0
X 852	0	0	1	0	0	0	10.6944	.2363	56.4000	0
X 853	0	0	1	0	0	0	10.6098	.4725	56.4000	0
X 854	0	0	1	0	0	0	10.6919	.5214	56.4000	0
X 855	0	0	1	0	0	0	10.6098	.5375	56.4000	0
X 856	0	0	1	0	0	0	10.6098	1.0222	56.4000	0
X 857	0	0	1	0	0	0	10.0926	1.5436	56.4000	0
X 858	0	0	1	0	0	0	9.5754	2.0650	56.4000	0
X 876	0	0	1	0	0	0	12.2166	0.0000	56.4000	0
X 877	0	0	1	0	0	0	12.2338	.2362	56.4000	0
X 878	0	0	1	0	0	0	12.2300	.4725	56.4000	0
X 879	0	0	1	0	0	0	12.2255	.5666	56.4000	0
X 880	0	0	1	0	0	0	12.2211	.6607	56.4000	0
X 881	0	0	1	0	0	0	12.2166	.7548	56.4000	0
X 901	0	0	1	0	0	0	13.8234	0.0000	56.4000	0
X 902	0	0	1	0	0	0	13.7950	.2363	56.4000	0
X 903	0	0	1	0	0	0	13.8234	.4725	56.4000	0
X 904	0	0	1	0	0	0	13.8234	.4775	56.4000	0
X 905	0	0	1	0	0	0	13.8234	.4825	56.4000	0
X 906	0	0	1	0	0	0	13.8234	.4875	56.4000	0
X 926	0	0	1	0	0	0	15.3068	0.0000	56.4000	0
X 927	0	0	1	0	0	0	15.2992	.2362	56.4000	0
X 928	0	0	1	0	0	0	15.3068	.4725	56.4000	0
X 951	0	0	1	0	0	0	16.7903	0.0000	56.4000	0
X 952	0	0	1	0	0	0	16.7883	.2362	56.4000	0
X 953	0	0	1	0	0	0	16.7903	.4725	56.4000	0
X 976	0	0	1	0	0	0	18.2737	0.0000	56.4000	0
X 977	0	0	1	0	0	0	18.2737	.2363	56.4000	0

X 978	0	0	1	0	0	0	18.2737	.4725	56.4000	0
X1001	1	1	1	0	0	0	7.9950	0.0000	59.9000	0
X1002	1	1	1	0	0	0	7.9950	.2363	59.9000	0
X1003	1	1	1	0	0	0	7.9950	.4725	59.9000	0
X1004	1	1	1	0	0	0	7.9950	.5050	59.9000	0
X1005	1	1	1	0	0	0	7.9950	.5375	59.9000	0
X1006	1	1	1	0	0	0	8.0218	1.0467	59.9000	0
X1007	0	0	1	0	0	0	8.0486	1.5558	59.9000	0
X1008	0	0	1	0	0	0	8.0754	2.0650	59.9000	0
X1026	0	1	1	0	0	0	9.3024	0.0000	59.9000	0
X1027	0	0	1	0	0	0	9.3237	.2363	59.9000	0
X1028	0	0	1	0	0	0	9.3024	.4725	59.9000	0
X1029	0	0	1	0	0	0	9.3229	.5091	59.9000	0
X1030	0	0	1	0	0	0	9.3024	.5375	59.9000	0
X1031	0	0	1	0	0	0	9.2273	1.0241	59.9000	0
X1032	0	0	1	0	0	0	9.0485	1.5471	59.9000	0
X1033	0	0	1	0	0	0	8.8254	2.0650	59.9000	0
X1051	0	1	1	0	0	0	10.6098	0.0000	59.9000	0
X1052	0	0	1	0	0	0	10.6942	.2362	59.9000	0
X1053	0	0	1	0	0	0	10.6098	.4725	59.9000	0
X1054	0	0	1	0	0	0	10.6920	.5214	59.9000	0
X1055	0	0	1	0	0	0	10.6098	.5375	59.9000	0
X1056	1	1	1	0	0	0	10.5366	.9650	59.9000	0
X1057	1	1	1	0	0	0	10.0926	1.5436	59.9000	0
X1058	0	0	1	0	0	0	9.5754	2.0650	59.9000	0
X1076	0	1	1	0	0	0	12.2166	0.0000	59.9000	0
X1077	0	0	1	0	0	0	12.2341	.2363	59.9000	0
X1078	0	0	1	0	0	0	12.2300	.4725	59.9000	0
X1079	0	0	1	0	0	0	12.2255	.5666	59.9000	0
X1080	0	0	1	0	0	0	12.2211	.6607	59.9000	0
X1081	1	1	1	0	0	0	12.2166	.7548	59.9000	0
X 882	1	1	1	0	0	0	11.9580	1.5436	56.4000	0
X1082	0	0	1	0	0	0	11.9580	1.5436	59.9000	0
X1101	0	1	1	0	0	0	13.8234	0.0000	59.9000	0
X1102	0	0	1	0	0	0	13.7950	.2363	59.9000	0
X1103	0	0	1	0	0	0	13.8234	.4725	59.9000	0
X1104	0	0	1	0	0	0	13.8234	.4775	59.9000	0
X1105	0	0	1	0	0	0	13.8234	.4825	59.9000	0
X1106	1	1	1	0	0	0	13.8234	.4875	59.9000	0
X 907	1	1	1	0	0	0	13.8234	1.5436	56.4000	0
X1107	0	0	1	0	0	0	13.8234	1.5436	59.9000	0
X1126	0	1	1	0	0	0	15.3068	0.0000	59.9000	0
X1127	0	0	1	0	0	0	15.2993	.2363	59.9000	0
X1128	0	0	1	0	0	0	15.3068	.4725	59.9000	0
X1151	0	1	1	0	0	0	16.7903	0.0000	59.9000	0
X1152	0	0	1	0	0	0	16.7884	.2363	59.9000	0
X1153	0	0	1	0	0	0	16.7903	.4725	59.9000	0
X1176	0	1	1	0	0	0	18.2737	0.0000	59.9000	0
X1177	0	0	1	0	0	0	18.2737	.2363	59.9000	0
X1178	0	0	1	0	0	0	18.2737	.4725	59.9000	0
7201	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8201	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9201	0	0	0	0	0	0	0.0000	0.0000	1.0000	0
7202	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8202	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9202	0	0	0	0	0	0	0.0000	0.0000	1.0000	0
7203	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8203	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9203	0	0	0	0	0	0	0.0000	0.0000	1.0000	0
7204	0	0	0	0	0	0	0.0000	0.0000	0.0000	0

ADNPX

[illegible]

8432	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9432	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7251	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8251	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9251	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7452	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8452	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9452	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7453	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8453	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9453	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7454	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8454	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9454	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7455	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8455	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9455	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7276	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8276	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9276	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7477	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8477	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9477	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7478	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8478	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9478	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7479	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8479	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9479	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7480	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8480	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9480	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7301	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8301	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9301	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7502	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8502	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9502	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7326	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8326	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9326	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7527	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8527	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9527	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7351	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8351	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9351	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7552	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8552	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9552	0	0	0	0	0	0	0.0000	-.3223	.9466	0
7201	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8201	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9201	0	0	0	0	0	0	0.0000	-.6101	.7923	0
7602	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8602	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9602	0	0	0	0	0	0	0.0000	-.6101	.7923	0
7603	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8603	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9603	0	0	0	0	0	0	0.0000	-.6101	.7923	0
7604	0	0	0	0	0	0	0.0000	0.0000	0.0000	0

8680	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9680	0	0	0	0	0	0	0.0000	-.6101	.7923	0
7301	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8301	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9301	0	0	0	0	0	0	0.0000	-.6101	.7923	0
7702	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8702	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9702	0	0	0	0	0	0	0.0000	-.6101	.7923	0
7326	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8326	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9326	0	0	0	0	0	0	0.0000	-.6101	.7923	0
7727	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8727	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9727	0	0	0	0	0	0	0.0000	-.6101	.7923	0
7351	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8351	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9351	0	0	0	0	0	0	0.0000	-.6101	.7923	0
7752	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8752	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9752	0	0	0	0	0	0	0.0000	-.6101	.7923	0
7201	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8201	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9201	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7802	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8802	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9802	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7803	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8803	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9803	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7804	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8804	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9804	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7805	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8805	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9805	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7806	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8806	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9806	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7807	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8807	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9807	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7226	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8226	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9226	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7827	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8827	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9827	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7828	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8828	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9828	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7829	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8829	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9829	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7830	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8830	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9830	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7831	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8831	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9831	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7832	0	0	0	0	0	0	0.0000	0.0000	0.0000	0

8832	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9832	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7251	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8251	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9251	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7852	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8852	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9852	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7853	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8853	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9853	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7854	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8854	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9854	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7855	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8855	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9855	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7856	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8856	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9856	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7276	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8276	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9276	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7877	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8877	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9877	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7878	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8878	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9878	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7879	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8879	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9879	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7880	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8880	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9880	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7881	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8881	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9881	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7301	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8301	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9301	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7902	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8902	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9902	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7326	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8326	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9326	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7927	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8927	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9927	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7351	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8351	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9351	0	0	0	0	0	0	0.0000	-.8329	.5534	0
7952	0	0	0	0	0	0	0.0000	0.0000	0.0000	0
8952	0	0	0	0	0	0	1.0000	0.0000	0.0000	0
9952	0	0	0	0	0	0	0.0000	-.8329	.5534	0
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86 7702 8702 9702
87 7326 8326 9326
88 7727 8727 9727
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112	7877	8877	9877				
113	7878	8878	9878				
114	7879	8879	9879				
115	7880	8880	9880				
116	7881	8881	9881				
117	7301	8301	9301				
118	7902	8902	9902				
119	7326	8326	9326				
120	7927	8927	9927				
121	7351	8351	9351				
122	7952	8952	9952				
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201	202	402	401	226	227	427	426
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202	203	403	402	227	228	428	427
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203	204	404	403	228	229	429	428
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204	205	405	404	229	230	430	429
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205	206	406	405	230	231	431	430
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206	207	407	406	231	232	432	431
7	8	8	0	1	7	0	0
207	208	408	407	232	233	433	432
8	8	8	0	2	8	0	0
226	227	427	426	251	252	452	451
9	8	8	0	2	9	0	0
227	228	428	427	252	253	453	452
10	8	8	0	1	10	0	0
228	229	429	428	253	254	454	453
11	8	8	0	1	11	0	0
229	230	430	429	254	255	455	454
12	8	8	0	1	12	0	0
230	231	431	430	255	256	456	455
13	8	8	0	1	13	0	0
231	232	432	431	256	257	457	456
14	8	8	0	1	14	0	0
232	233	433	432	257	258	458	457
15	8	8	0	2	15	0	0
251	252	452	451	276	277	477	476
16	8	8	0	2	16	0	0
252	253	453	452	277	278	478	477
17	8	8	0	1	17	0	0
253	254	454	453	278	279	479	478
18	8	8	0	1	18	0	0
254	255	455	454	279	280	480	479
19	8	8	0	1	19	0	0
255	256	456	455	280	281	481	480
20	8	8	0	2	20	0	0
276	277	477	476	301	302	502	501
21	8	8	0	2	21	0	0
277	278	478	477	302	303	503	502
22	8	8	0	1	22	0	0
278	279	479	478	303	304	504	503
23	8	8	0	1	23	0	0
279	280	480	479	304	305	505	504
24	8	8	0	1	24	0	0
280	281	481	480	305	306	506	505

ADELD

25	8	8	0	2	25	0	0
301	302	502	501	326	327	527	526
26	8	8	0	2	26	0	0
302	303	503	502	327	328	528	527
27	8	8	0	2	27	0	0
326	327	527	526	351	352	552	551
28	8	8	0	2	28	0	0
327	328	528	527	352	353	553	552
29	8	8	0	1	29	0	0
351	352	552	551	376	377	577	576
30	8	8	0	1	30	0	0
352	353	553	552	377	378	578	577
31	8	8	0	2	31	0	0
201	402	602	601	226	427	627	626
32	8	8	0	2	32	0	0
402	403	603	602	427	428	628	627
33	8	8	0	1	33	0	0
403	404	604	603	428	429	629	628
34	8	8	0	1	34	0	0
404	405	605	604	429	430	630	629
35	8	8	0	1	35	0	0
405	406	606	605	430	431	631	630
36	8	8	0	1	36	0	0
406	407	607	606	431	432	632	631
37	8	8	0	1	37	0	0
407	408	608	607	432	433	633	632
38	8	8	0	2	38	0	0
226	427	627	626	251	452	652	651
39	8	8	0	2	39	0	0
427	428	628	627	452	453	653	652
40	8	8	0	1	40	0	0
428	429	629	628	453	454	654	653
41	8	8	0	1	41	0	0
429	430	630	629	454	455	655	654
42	8	8	0	1	42	0	0
430	431	631	630	455	456	656	655
43	8	8	0	1	43	0	0
431	432	632	631	456	457	657	656
44	8	8	0	1	44	0	0
432	433	633	632	457	458	658	657
45	8	8	0	2	45	0	0
251	452	652	651	276	477	677	676
46	8	8	0	2	46	0	0
452	453	653	652	477	478	678	677
47	8	8	0	1	47	0	0
453	454	654	653	478	479	679	678
48	8	8	0	1	48	0	0
454	455	655	654	479	480	680	679
49	8	8	0	1	49	0	0
455	456	656	655	480	481	681	680
50	8	8	0	2	50	0	0
276	477	677	676	301	502	702	701
51	8	8	0	2	51	0	0
477	478	678	677	502	503	703	702
52	8	8	0	1	52	0	0
478	479	679	678	503	504	704	703
53	8	8	0	1	53	0	0
479	480	680	679	504	505	705	704
54	8	8	0	1	54	0	0
480	481	681	680	505	506	706	705

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301	502	702	701	326	527	727	726
56	8	8	0	2	56	0	0
502	503	703	702	527	528	728	727
57	8	8	0	2	57	0	0
326	527	727	726	351	552	752	751
58	8	8	0	2	58	0	0
527	528	728	727	552	553	753	752
59	8	8	0	1	59	0	0
351	552	752	751	376	577	777	776
60	8	8	0	1	60	0	0
552	553	753	752	577	578	778	777
61	8	8	0	2	61	0	0
201	602	802	801	226	627	827	826
62	8	8	0	2	62	0	0
602	603	803	802	627	628	828	827
63	8	8	0	1	63	0	0
603	604	804	803	628	629	829	828
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605	606	806	805	630	631	831	830
66	8	8	0	1	66	0	0
606	607	807	806	631	632	832	831
67	8	8	0	1	67	0	0
607	608	808	807	632	633	833	832
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226	627	827	826	251	652	852	851
69	8	8	0	2	69	0	0
627	628	828	827	652	653	853	852
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628	629	829	828	653	654	854	853
71	8	8	0	1	71	0	0
629	630	830	829	654	655	855	854
72	8	8	0	1	72	0	0
630	631	831	830	655	656	856	855
73	8	8	0	1	73	0	0
631	632	832	831	656	657	857	856
74	8	8	0	1	74	0	0
632	633	833	832	657	658	858	857
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251	652	852	851	276	677	877	876
76	8	8	0	2	76	0	0
652	653	853	852	677	678	878	877
77	8	8	0	1	77	0	0
653	654	854	853	678	679	879	878
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654	655	855	854	679	680	880	879
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276	677	877	876	301	702	902	901
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677	678	878	877	702	703	903	902
82	8	8	0	1	82	0	0
678	679	879	878	703	704	904	903
83	8	8	0	1	83	0	0
679	680	880	879	704	705	905	904
84	8	8	0	1	84	0	0
680	681	881	880	705	706	906	905

85	8	8	0	2	85	0	0
301	702	902	901	326	727	927	926
86	8	8	0	2	86	0	0
702	703	903	902	727	728	928	927
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326	727	927	926	351	752	952	951
88	8	8	0	2	88	0	0
727	728	928	927	752	753	953	952
89	8	8	0	1	89	0	0
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752	753	953	952	777	778	978	977
91	8	8	0	2	91	0	0
201	802	1002	1001	226	827	1027	1026
92	8	8	0	2	92	0	0
802	803	1003	1002	827	828	1028	1027
93	8	8	0	1	93	0	0
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804	805	1005	1004	829	830	1030	1029
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805	806	1006	1005	830	831	1031	1030
96	8	8	0	1	96	0	0
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97	8	8	0	1	97	0	0
807	808	1008	1007	832	833	1033	1032
98	8	8	0	2	98	0	0
226	827	1027	1026	251	852	1052	1051
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101	8	8	0	1	101	0	0
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102	8	8	0	1	102	0	0
830	831	1031	1030	855	856	1056	1055
103	8	8	0	1	103	0	0
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104	8	8	0	1	104	0	0
832	833	1033	1032	857	858	1058	1057
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251	852	1052	1051	276	877	1077	1076
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852	853	1053	1052	877	878	1078	1077
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853	854	1054	1053	878	879	1079	1078
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855	856	1056	1055	880	881	1081	1080
110	8	8	0	3	110	0	0
856	857	1057	1056	881	882	1082	1081
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276	877	1077	1076	301	902	1102	1101
112	8	8	0	2	112	0	0
877	878	1078	1077	902	903	1103	1102
113	8	8	0	1	113	0	0
878	879	1079	1078	903	904	1104	1103
114	8	8	0	1	114	0	0
879	880	1080	1079	904	905	1105	1104

115	8	8	0	1	115	0	0
880	881	1081	1080	905	906	1106	1105
116	8	8	0	3	116	0	0
881	882	1082	1081	906	907	1107	1106
117	8	8	0	2	117	0	0
301	902	1102	1101	326	927	1127	1126
118	8	8	0	2	118	0	0
902	903	1103	1102	927	928	1128	1127
119	8	8	0	2	119	0	0
326	927	1127	1126	351	952	1152	1151
120	8	8	0	2	120	0	0
927	928	1128	1127	952	953	1153	1152
121	8	8	0	1	121	0	0
351	952	1152	1151	376	977	1177	1176
122	8	8	0	1	122	0	0
952	953	1153	1152	977	978	1178	1177

APPENDIX D

Listing of File NAS,
the Input Cards for NASTRAN Program

GRID	2003	1	1.2500	0.0000	0.0000	1	2456
GRID	4003	1	1.2500	12.0000	0.0000	1	456
GRID	2004	1	1.5000	0.0000	0.0000	1	2456
GRID	4004	1	1.5000	12.0000	0.0000	1	456
GRID	2005	1	1.7500	0.0000	0.0000	1	2456
GRID	4005	1	1.7500	12.0000	0.0000	1	456
GRID	2006	1	2.0000	0.0000	0.0000	1	2456
GRID	4006	1	2.0000	12.0000	0.0000	1	456
GRID	2028	1	1.2500	0.0000	.5000	1	2456
GRID	4028	1	1.2500	12.0000	.5000	1	456
GRID	2029	1	1.5000	0.0000	.5000	1	2456
GRID	4029	1	1.5000	12.0000	.5000	1	456
GRID	2030	1	1.7500	0.0000	.5000	1	2456
GRID	4030	1	1.7500	12.0000	.5000	1	456
GRID	2031	1	2.0000	0.0000	.5000	1	2456
GRID	4031	1	2.0000	12.0000	.5000	1	456
GRID	2053	1	1.2500	0.0000	1.0000	1	2456
GRID	4053	1	1.2500	12.0000	1.0000	1	456
GRID	2054	1	1.5000	0.0000	1.0000	1	2456
GRID	4054	1	1.5000	12.0000	1.0000	1	456
GRID	2055	1	1.7500	0.0000	1.0000	1	2456
GRID	4055	1	1.7500	12.0000	1.0000	1	456
GRID	2056	1	2.0000	0.0000	1.0000	1	2456
GRID	4056	1	2.0000	12.0000	1.0000	1	456
GRID	2077	1	1.0000	0.0000	1.5000	1	2456
GRID	4077	1	1.0000	12.0000	1.5000	1	456
GRID	2078	1	1.2500	0.0000	1.5000	1	2456
GRID	4078	1	1.2500	12.0000	1.5000	1	456
GRID	2079	1	1.5000	0.0000	1.5000	1	2456
GRID	4079	1	1.5000	12.0000	1.5000	1	456
GRID	2080	1	1.7500	0.0000	1.5000	1	2456
GRID	4080	1	1.7500	12.0000	1.5000	1	456
GRID	2081	1	2.0000	0.0000	1.5000	1	2456
GRID	4081	1	2.0000	12.0000	1.5000	1	456
GRID	2102	1	1.0000	0.0000	2.0000	1	2456
GRID	4102	1	1.0000	12.0000	2.0000	1	456
GRID	2103	1	1.2500	0.0000	2.0000	1	2456
GRID	4103	1	1.2500	12.0000	2.0000	1	456
GRID	2104	1	1.5000	0.0000	2.0000	1	2456
GRID	4104	1	1.5000	12.0000	2.0000	1	456
GRID	2105	1	1.7500	0.0000	2.0000	1	2456
GRID	4105	1	1.7500	12.0000	2.0000	1	456
GRID	2106	1	2.0000	0.0000	2.0000	1	2456
GRID	4106	1	2.0000	12.0000	2.0000	1	456
GRID	2127	1	1.0000	0.0000	2.5000	1	2456
GRID	4127	1	1.0000	12.0000	2.5000	1	456
GRID	2128	1	1.2500	0.0000	2.5000	1	2456
GRID	4128	1	1.2500	12.0000	2.5000	1	456
GRID	2129	1	1.5000	0.0000	2.5000	1	2456
GRID	4129	1	1.5000	12.0000	2.5000	1	456
GRID	2130	1	1.7500	0.0000	2.5000	1	2456
GRID	4130	1	1.7500	12.0000	2.5000	1	456
GRID	2131	1	2.0000	0.0000	2.5000	1	2456
GRID	4131	1	2.0000	12.0000	2.5000	1	456
GRID	2152	1	1.0000	0.0000	3.0000	1	2456
GRID	4152	1	1.0000	12.0000	3.0000	1	456
GRID	2153	1	1.2500	0.0000	3.0000	1	2456
GRID	4153	1	1.2500	12.0000	3.0000	1	456
GRID	2154	1	1.5000	0.0000	3.0000	1	2456

	GRID	4154	1	1.5000	12.0000	3.0000	1	456	
	GRID	2155	1	1.7500	0.0000	3.0000	1	2456	
	GRID	4155	1	1.7500	12.0000	3.0000	1	456	
	GRID	2156	1	2.0000	0.0000	3.0000	1	2456	
	GRID	4156	1	2.0000	12.0000	3.0000	1	456	
	GRID	2177	1	1.0000	0.0000	3.5000	1	2456	
	GRID	4177	1	1.0000	12.0000	3.5000	1	456	
	GRID	2178	1	1.2500	0.0000	3.5000	1	2456	
	GRID	4178	1	1.2500	12.0000	3.5000	1	456	
	GRID	2179	1	1.5000	0.0000	3.5000	1	2456	
	GRID	4179	1	1.5000	12.0000	3.5000	1	456	
	GRID	2180	1	1.7500	0.0000	3.5000	1	2456	
	GRID	4180	1	1.7500	12.0000	3.5000	1	456	
	GRID	2181	1	2.0000	0.0000	3.5000	1	2456	
	GRID	4181	1	2.0000	12.0000	3.5000	1	456	
	GRID	2202	1	1.0000	0.0000	4.0000	1	23456	
	GRID	4202	1	1.0000	12.0000	4.0000	1	3456	
	GRID	2203	1	1.2500	0.0000	4.0000	1	2456	
	GRID	4203	1	1.2500	12.0000	4.0000	1	456	
	GRID	2204	1	1.5000	0.0000	4.0000	1	2456	
	GRID	4204	1	1.5000	12.0000	4.0000	1	456	
	GRID	2205	1	1.7500	0.0000	4.0000	1	2456	
	GRID	4205	1	1.7500	12.0000	4.0000	1	456	
	GRID	2206	1	2.0000	0.0000	4.0000	1	2456	
	GRID	4206	1	2.0000	12.0000	4.0000	1	456	
	CHEXA	2001	1	2003	2004	4004	4003	2028	2029CBC
2001	+BC 2001	4029	4028						
	CHEXA	2002	1	2004	2005	4005	4004	2029	2030CBC
2002	+BC 2002	4030	4029						
	CHEXA	2003	1	2005	2006	4006	4005	2030	2031CBC
2003	+BC 2003	4031	4030						
	CHEXA	2004	1	2028	2029	4029	4028	2053	2054CBC
2004	+BC 2004	4054	4053						
	CHEXA	2005	1	2029	2030	4030	4029	2054	2055CBC
2005	+BC 2005	4055	4054						
	CHEXA	2006	1	2030	2031	4031	4030	2055	2056CBC
2006	+BC 2006	4056	4055						
	CHEXA	2007	1	2053	2054	4054	4053	2078	2079CBC
2007	+BC 2007	4079	4078						
	CHEXA	2008	1	2054	2055	4055	4054	2079	2080CBC
2008	+BC 2008	4080	4079						
	CHEXA	2009	1	2055	2056	4056	4055	2080	2081CBC
2009	+BC 2009	4081	4080						
	CHEXA	2010	1	2077	2078	4078	4077	2102	2103CBC
2010	+BC 2010	4103	4102						
	CHEXA	2011	1	2078	2079	4079	4078	2103	2104CBC
2011	+BC 2011	4104	4103						
	CHEXA	2012	1	2079	2080	4080	4079	2104	2105CBC
2012									

2013	+BC 2012 CHEXA	4105 2013	4104 1	2080	2081	4081	4080	2105	2106CBC
2014	+BC 2013 CHEXA	4106 2014	4105 1	2102	2103	4103	4102	2127	2128CBC
2015	+BC 2014 CHEXA	4128 2015	4127 1	2103	2104	4104	4103	2128	2129CBC
2016	+BC 2015 CHEXA	4129 2016	4128 1	2104	2105	4105	4104	2129	2130CBC
2017	+BC 2016 CHEXA	4130 2017	4129 1	2105	2106	4106	4105	2130	2131CBC
2018	+BC 2017 CHEXA	4131 2018	4130 1	2127	2128	4128	4127	2152	2153CBC
2019	+BC 2018 CHEXA	4153 2019	4152 1	2128	2129	4129	4128	2153	2154CBC
2020	+BC 2019 CHEXA	4154 2020	4153 1	2129	2130	4130	4129	2154	2155CBC
2021	+BC 2020 CHEXA	4155 2021	4154 1	2130	2131	4131	4130	2155	2156CBC
2022	+BC 2021 CHEXA	4156 2022	4155 1	2152	2153	4153	4152	2177	2178CBC
2023	+BC 2022 CHEXA	4178 2023	4177 1	2153	2154	4154	4153	2178	2179CBC
2024	+BC 2023 CHEXA	4179 2024	4178 1	2154	2155	4155	4154	2179	2180CBC
2025	+BC 2024 CHEXA	4180 2025	4179 1	2155	2156	4156	4155	2180	2181CBC
2026	+BC 2025 CHEXA	4181 2026	4180 1	2177	2178	4178	4177	2202	2203CBC
2027	+BC 2026 CHEXA	4203 2027	4202 1	2178	2179	4179	4178	2203	2204CBC
2028	+BC 2027 CHEXA	4204 2028	4203 1	2179	2180	4180	4179	2204	2205CBC
2029	+BC 2028 CHEXA	4205 2029	4204 1	2180	2181	4181	4180	2205	2206CBC
	+BC 2029 PLOAD	4206	4205						
	PLOAD	130000.00		2077	2078	4078	4077		
	PLOAD	130000.00		2078	2053	4053	4078		
	PLOAD	130000.00		2053	2028	4028	4053		
	PLOAD	130000.00		2028	2003	4003	4028		
	PLOAD	130000.00		2003	2004	4004	4003		
	PLOAD	130000.00		2004	2005	4005	4004		
	PLOAD	130000.00		2005	2006	4006	4005		
	PLOAD	130000.00		2006	2031	4031	4006		

PLOAD		130000.00	2031	2056	4056	4031	
PLOAD		130000.00	2056	2081	4081	4056	
GRID	10003	1	1.2500	78.0000	0.0000	1	456
GRID	12003	1	1.2500	90.0000	0.0000	1	2456
GRID	10004	1	1.5000	78.0000	0.0000	1	456
GRID	12004	1	1.5000	90.0000	0.0000	1	2456
GRID	10005	1	1.7500	78.0000	0.0000	1	456
GRID	12005	1	1.7500	90.0000	0.0000	1	2456
GRID	10006	1	2.0000	78.0000	0.0000	1	456
GRID	12006	1	2.0000	90.0000	0.0000	1	2456
GRID	10028	1	1.2500	78.0000	.5000	1	456
GRID	12028	1	1.2500	90.0000	.5000	1	2456
GRID	10029	1	1.5000	78.0000	.5000	1	456
GRID	12029	1	1.5000	90.0000	.5000	1	2456
GRID	10030	1	1.7500	78.0000	.5000	1	456
GRID	12030	1	1.7500	90.0000	.5000	1	2456
GRID	10031	1	2.0000	78.0000	.5000	1	456
GRID	12031	1	2.0000	90.0000	.5000	1	2456
GRID	10053	1	1.2500	78.0000	1.0000	1	456
GRID	12053	1	1.2500	90.0000	1.0000	1	2456
GRID	10054	1	1.5000	78.0000	1.0000	1	456
GRID	12054	1	1.5000	90.0000	1.0000	1	2456
GRID	10055	1	1.7500	78.0000	1.0000	1	456
GRID	12055	1	1.7500	90.0000	1.0000	1	2456
GRID	10056	1	2.0000	78.0000	1.0000	1	456
GRID	12056	1	2.0000	90.0000	1.0000	1	2456
GRID	10077	1	1.0000	78.0000	1.5000	1	456
GRID	12077	1	1.0000	90.0000	1.5000	1	2456
GRID	10078	1	1.2500	78.0000	1.5000	1	456
GRID	12078	1	1.2500	90.0000	1.5000	1	2456
GRID	10079	1	1.5000	78.0000	1.5000	1	456
GRID	12079	1	1.5000	90.0000	1.5000	1	2456
GRID	10080	1	1.7500	78.0000	1.5000	1	456
GRID	12080	1	1.7500	90.0000	1.5000	1	2456
GRID	10081	1	2.0000	78.0000	1.5000	1	456
GRID	12081	1	2.0000	90.0000	1.5000	1	2456
GRID	10102	1	1.0000	78.0000	2.0000	1	456
GRID	12102	1	1.0000	90.0000	2.0000	1	2456
GRID	10103	1	1.2500	78.0000	2.0000	1	456
GRID	12103	1	1.2500	90.0000	2.0000	1	2456
GRID	10104	1	1.5000	78.0000	2.0000	1	456
GRID	12104	1	1.5000	90.0000	2.0000	1	2456
GRID	10105	1	1.7500	78.0000	2.0000	1	456
GRID	12105	1	1.7500	90.0000	2.0000	1	2456
GRID	10106	1	2.0000	78.0000	2.0000	1	456
GRID	12106	1	2.0000	90.0000	2.0000	1	2456
GRID	10127	1	1.0000	78.0000	2.5000	1	456
GRID	12127	1	1.0000	90.0000	2.5000	1	2456
GRID	10128	1	1.2500	78.0000	2.5000	1	456
GRID	12128	1	1.2500	90.0000	2.5000	1	2456
GRID	10129	1	1.5000	78.0000	2.5000	1	456
GRID	12129	1	1.5000	90.0000	2.5000	1	2456
GRID	10130	1	1.7500	78.0000	2.5000	1	456
GRID	12130	1	1.7500	90.0000	2.5000	1	2456
GRID	10131	1	2.0000	78.0000	2.5000	1	456
GRID	12131	1	2.0000	90.0000	2.5000	1	2456
GRID	10152	1	1.0000	78.0000	3.0000	1	456
GRID	12152	1	1.0000	90.0000	3.0000	1	2456
GRID	10153	1	1.2500	78.0000	3.0000	1	456
GRID	12153	1	1.2500	90.0000	3.0000	1	2456

GRID	10154	1	1.5000	78.0000	3.0000	1	456		
GRID	12154	1	1.5000	90.0000	3.0000	1	2456		
GRID	10155	1	1.7500	78.0000	3.0000	1	456		
GRID	12155	1	1.7500	90.0000	3.0000	1	2456		
GRID	10156	1	2.0000	78.0000	3.0000	1	456		
GRID	12156	1	2.0000	90.0000	3.0000	1	2456		
GRID	10177	1	1.0000	78.0000	3.5000	1	456		
GRID	12177	1	1.0000	90.0000	3.5000	1	2456		
GRID	10178	1	1.2500	78.0000	3.5000	1	456		
GRID	12178	1	1.2500	90.0000	3.5000	1	2456		
GRID	10179	1	1.5000	78.0000	3.5000	1	456		
GRID	12179	1	1.5000	90.0000	3.5000	1	2456		
GRID	10180	1	1.7500	78.0000	3.5000	1	456		
GRID	12180	1	1.7500	90.0000	3.5000	1	2456		
GRID	10181	1	2.0000	78.0000	3.5000	1	456		
GRID	12181	1	2.0000	90.0000	3.5000	1	2456		
GRID	10202	1	1.0000	78.0000	4.0000	1	3456		
GRID	12202	1	1.0000	90.0000	4.0000	1	23456		
GRID	10203	1	1.2500	78.0000	4.0000	1	456		
GRID	12203	1	1.2500	90.0000	4.0000	1	2456		
GRID	10204	1	1.5000	78.0000	4.0000	1	456		
GRID	12204	1	1.5000	90.0000	4.0000	1	2456		
GRID	10205	1	1.7500	78.0000	4.0000	1	456		
GRID	12205	1	1.7500	90.0000	4.0000	1	2456		
GRID	10206	1	2.0000	78.0000	4.0000	1	456		
GRID	12206	1	2.0000	90.0000	4.0000	1	2456		
CHEXA	10001	1	10003	10004	12004	12003	10028	10029CBC	
10001	+BC10001	12029	12028						
	CHEXA	10002	1	10004	10005	12005	12004	10029	10030CBC
10002	+BC10002	12030	12029						
	CHEXA	10003	1	10005	10006	12006	12005	10030	10031CBC
10003	+BC10003	12031	12030						
	CHEXA	10004	1	10028	10029	12029	12028	10053	10054CBC
10004	+BC10004	12054	12053						
	CHEXA	10005	1	10029	10030	12030	12029	10054	10055CBC
10005	+BC10005	12055	12054						
	CHEXA	10006	1	10030	10031	12031	12030	10055	10056CBC
10006	+BC10006	12056	12055						
	CHEXA	10007	1	10053	10054	12054	12053	10078	10079CBC
10007	+BC10007	12079	12078						
	CHEXA	10008	1	10054	10055	12055	12054	10079	10080CBC
10008	+BC10008	12080	12079						
	CHEXA	10009	1	10055	10056	12056	12055	10080	10081CBC
10009	+BC10009	12081	12080						
	CHEXA	10010	1	10077	10078	12078	12077	10102	10103CBC
10010	+BC10010	12103	12102						
	CHEXA	10011	1	10078	10079	12079	12078	10103	10104CBC
10011	+BC10011	12104	12103						
	CHEXA	10012	1	10079	10080	12080	12079	10104	10105CBC

10012	+BC10012	12105	12104						
	CHEXA	10013	1	10080	10081	12081	12080	10105	10106CBC
10013	+BC10013	12106	12105						
	CHEXA	10014	1	10102	10103	12103	12102	10127	10128CBC
10014	+BC10014	12128	12127						
	CHEXA	10015	1	10103	10104	12104	12103	10128	10129CBC
10015	+BC10015	12129	12128						
	CHEXA	10016	1	10104	10105	12105	12104	10129	10130CBC
10016	+BC10016	12130	12129						
	CHEXA	10017	1	10105	10106	12106	12105	10130	10131CBC
10017	+BC10017	12131	12130						
	CHEXA	10018	1	10127	10128	12128	12127	10152	10153CBC
10018	+BC10018	12153	12152						
	CHEXA	10019	1	10128	10129	12129	12128	10153	10154CBC
10019	+BC10019	12154	12153						
	CHEXA	10020	1	10129	10130	12130	12129	10154	10155CBC
10020	+BC10020	12155	12154						
	CHEXA	10021	1	10130	10131	12131	12130	10155	10156CBC
10021	+BC10021	12156	12155						
	CHEXA	10022	1	10152	10153	12153	12152	10177	10178CBC
10022	+BC10022	12178	12177						
	CHEXA	10023	1	10153	10154	12154	12153	10178	10179CBC
10023	+BC10023	12179	12178						
	CHEXA	10024	1	10154	10155	12155	12154	10179	10180CBC
10024	+BC10024	12180	12179						
	CHEXA	10025	1	10155	10156	12156	12155	10180	10181CBC
10025	+BC10025	12181	12180						
	CHEXA	10026	1	10177	10178	12178	12177	10202	10203CBC
10026	+BC10026	12203	12202						
	CHEXA	10027	1	10178	10179	12179	12178	10203	10204CBC
10027	+BC10027	12204	12203						
	CHEXA	10028	1	10179	10180	12180	12179	10204	10205CBC
10028	+BC10028	12205	12204						
	CHEXA	10029	1	10180	10181	12181	12180	10205	10206CBC
10029	+BC10029	12206	12205						
	PLOAD	130000.00		10077	10078	12078	12077		
	PLOAD	130000.00		10078	10053	12053	12078		
	PLOAD	130000.00		10053	10028	12028	12053		
	PLOAD	130000.00		10028	10003	12003	12028		
	PLOAD	130000.00		10003	10004	12004	12003		
	PLOAD	130000.00		10004	10005	12005	12004		
	PLOAD	130000.00		10005	10006	12006	12005		

	FLOAD	130000.00	10006	10031	12031	12006	
	FLOAD	130000.00	10031	10056	12056	12031	
	FLOAD	130000.00	10056	10081	12081	12056	
GRID	4002	1	1.0000	12.0000	0.0000	1	456
GRID	6002	1	1.0000	34.0000	0.0000	1	456
GRID	6003	1	1.2500	34.0000	0.0000	1	456
GRID	6004	1	1.5000	34.0000	0.0000	1	456
GRID	6005	1	1.7500	34.0000	0.0000	1	456
GRID	6006	1	2.0000	34.0000	0.0000	1	456
GRID	6027	1	1.0000	12.0000	.5000	1	456
GRID	6027	1	1.0000	34.0000	.5000	1	456
GRID	6028	1	1.2500	34.0000	.5000	1	456
GRID	6029	1	1.5000	34.0000	.5000	1	456
GRID	6030	1	1.7500	34.0000	.5000	1	456
GRID	6031	1	2.0000	34.0000	.5000	1	456
GRID	4052	1	1.0000	12.0000	1.0000	1	456
GRID	6052	1	1.0000	34.0000	1.0000	1	456
GRID	6053	1	1.2500	34.0000	1.0000	1	456
GRID	6054	1	1.5000	34.0000	1.0000	1	456
GRID	6055	1	1.7500	34.0000	1.0000	1	456
GRID	6056	1	2.0000	34.0000	1.0000	1	456
GRID	6077	1	1.0000	34.0000	1.5000	1	456
GRID	6078	1	1.2500	34.0000	1.5000	1	456
GRID	6079	1	1.5000	34.0000	1.5000	1	456
GRID	6080	1	1.7500	34.0000	1.5000	1	456
GRID	6081	1	2.0000	34.0000	1.5000	1	456
GRID	6102	1	1.0000	34.0000	2.0000	1	456
GRID	6103	1	1.2500	34.0000	2.0000	1	456
GRID	6104	1	1.5000	34.0000	2.0000	1	456
GRID	6105	1	1.7500	34.0000	2.0000	1	456
GRID	6106	1	2.0000	34.0000	2.0000	1	456
GRID	6127	1	1.0000	34.0000	2.5000	1	456
GRID	6128	1	1.2500	34.0000	2.5000	1	456
GRID	6129	1	1.5000	34.0000	2.5000	1	456
GRID	6130	1	1.7500	34.0000	2.5000	1	456
GRID	6131	1	2.0000	34.0000	2.5000	1	456
GRID	6152	1	1.0000	34.0000	3.0000	1	456
GRID	6153	1	1.2500	34.0000	3.0000	1	456
GRID	6154	1	1.5000	34.0000	3.0000	1	456
GRID	6155	1	1.7500	34.0000	3.0000	1	456
GRID	6156	1	2.0000	34.0000	3.0000	1	456
GRID	6177	1	1.0000	34.0000	3.5000	1	456
GRID	6178	1	1.2500	34.0000	3.5000	1	456
GRID	6179	1	1.5000	34.0000	3.5000	1	456
GRID	6180	1	1.7500	34.0000	3.5000	1	456
GRID	6181	1	2.0000	34.0000	3.5000	1	456
GRID	6202	1	1.0000	34.0000	4.0000	1	3456
GRID	6203	1	1.2500	34.0000	4.0000	1	456
GRID	6204	1	1.5000	34.0000	4.0000	1	456
GRID	6205	1	1.7500	34.0000	4.0000	1	456
GRID	6206	1	2.0000	34.0000	4.0000	1	456
CHEXA	4001	1	4002	4003	6003	6002	4027 4028CBC
4001 +BC 4001	6028	6027					
CHEXA	4002	1	4003	4004	6004	6003	4028 4029CBC
4002 +BC 4002	6029	6028					
CHEXA	4003	1	4004	4005	6005	6004	4029 4030CBC
4003 +BC 4003	6030	6029					

4004	CHEXA	4004	1	4005	4006	6006	6005	4030	4031CBC
	+BC 4004	6031	6030						
4005	CHEXA	4005	1	4027	4028	6028	6027	4052	4053CBC
	+BC 4005	6053	6052						
4006	CHEXA	4006	1	4028	4029	6029	6028	4053	4054CBC
	+BC 4006	6054	6053						
4007	CHEXA	4007	1	4029	4030	6030	6029	4054	4055CBC
	+BC 4007	6055	6054						
4008	CHEXA	4008	1	4030	4031	6031	6030	4055	4056CBC
	+BC 4008	6056	6055						
4009	CHEXA	4009	1	4052	4053	6053	6052	4077	4078CBC
	+BC 4009	6078	6077						
4010	CHEXA	4010	1	4053	4054	6054	6053	4078	4079CBC
	+BC 4010	6079	6078						
4011	CHEXA	4011	1	4054	4055	6055	6054	4079	4080CBC
	+BC 4011	6080	6079						
4012	CHEXA	4012	1	4055	4056	6056	6055	4080	4081CBC
	+BC 4012	6081	6080						
4013	CHEXA	4013	1	4077	4078	6078	6077	4102	4103CBC
	+BC 4013	6103	6102						
4014	CHEXA	4014	1	4078	4079	6079	6078	4103	4104CBC
	+BC 4014	6104	6103						
4015	CHEXA	4015	1	4079	4080	6080	6079	4104	4105CBC
	+BC 4015	6105	6104						
4016	CHEXA	4016	1	4080	4081	6081	6080	4105	4106CBC
	+BC 4016	6106	6105						
4017	CHEXA	4017	1	4102	4103	6103	6102	4127	4128CBC
	+BC 4017	6128	6127						
4018	CHEXA	4018	1	4103	4104	6104	6103	4128	4129CBC
	+BC 4018	6129	6128						
4019	CHEXA	4019	1	4104	4105	6105	6104	4129	4130CBC
	+BC 4019	6130	6129						
4020	CHEXA	4020	1	4105	4106	6106	6105	4130	4131CBC
	+BC 4020	6131	6130						
4021	CHEXA	4021	1	4127	4128	6128	6127	4152	4153CBC
	+BC 4021	6153	6152						
4022	CHEXA	4022	1	4128	4129	6129	6128	4153	4154CBC
	+BC 4022	6154	6153						
4023	CHEXA	4023	1	4129	4130	6130	6129	4154	4155CBC
	+BC 4023	6155	6154						

4024	CHEXA	4024	1	4130	4131	6131	6130	4155	4156CBC
	+BC 4024	6156	6155						
4025	CHEXA	4025	1	4152	4153	6153	6152	4177	4178CBC
	+BC 4025	6178	6177						
4026	CHEXA	4026	1	4153	4154	6154	6153	4178	4179CBC
	+BC 4026	6179	6178						
4027	CHEXA	4027	1	4154	4155	6155	6154	4179	4180CBC
	+BC 4027	6180	6179						
4028	CHEXA	4028	1	4155	4156	6156	6155	4180	4181CBC
	+BC 4028	6181	6180						
4029	CHEXA	4029	1	4177	4178	6178	6177	4202	4203CBC
	+BC 4029	6203	6202						
4030	CHEXA	4030	1	4178	4179	6179	6178	4203	4204CBC
	+BC 4030	6204	6203						
4031	CHEXA	4031	1	4179	4180	6180	6179	4204	4205CBC
	+BC 4031	6205	6204						
4032	CHEXA	4032	1	4180	4181	6181	6180	4205	4206CBC
	+BC 4032	6206	6205						
	PLOAD	130000.00		4002	4003	6003	6002		
	PLOAD	130000.00		4003	4004	6004	6003		
	PLOAD	130000.00		4004	4005	6005	6004		
	PLOAD	130000.00		4005	4006	6006	6005		
	PLOAD	130000.00		4006	4031	6031	6006		
	PLOAD	130000.00		4031	4056	6056	6031		
	PLOAD	130000.00		4056	4081	6081	6056		
	GRID	8002	1	1.0000	56.0000	0.0000	1	456	
	GRID	8003	1	1.2500	56.0000	0.0000	1	456	
	GRID	8004	1	1.5000	56.0000	0.0000	1	456	
	GRID	8005	1	1.7500	56.0000	0.0000	1	456	
	GRID	8006	1	2.0000	56.0000	0.0000	1	456	
	GRID	8027	1	1.0000	56.0000	.5000	1	456	
	GRID	8028	1	1.2500	56.0000	.5000	1	456	
	GRID	8029	1	1.5000	56.0000	.5000	1	456	
	GRID	8030	1	1.7500	56.0000	.5000	1	456	
	GRID	8031	1	2.0000	56.0000	.5000	1	456	
	GRID	8052	1	1.0000	56.0000	1.0000	1	456	
	GRID	8053	1	1.2500	56.0000	1.0000	1	456	
	GRID	8054	1	1.5000	56.0000	1.0000	1	456	
	GRID	8055	1	1.7500	56.0000	1.0000	1	456	
	GRID	8056	1	2.0000	56.0000	1.0000	1	456	
	GRID	8077	1	1.0000	56.0000	1.5000	1	456	
	GRID	8078	1	1.2500	56.0000	1.5000	1	456	
	GRID	8079	1	1.5000	56.0000	1.5000	1	456	
	GRID	8080	1	1.7500	56.0000	1.5000	1	456	
	GRID	8081	1	2.0000	56.0000	1.5000	1	456	
	GRID	8102	1	1.0000	56.0000	2.0000	1	456	
	GRID	8103	1	1.2500	56.0000	2.0000	1	456	
	GRID	8104	1	1.5000	56.0000	2.0000	1	456	
	GRID	8105	1	1.7500	56.0000	2.0000	1	456	
	GRID	8106	1	2.0000	56.0000	2.0000	1	456	
	GRID	8127	1	1.0000	56.0000	2.5000	1	456	

GRID	8128	1	1.2500	56.0000	2.5000	1	456		
GRID	8129	1	1.5000	56.0000	2.5000	1	456		
GRID	8130	1	1.7500	56.0000	2.5000	1	456		
GRID	8131	1	2.0000	56.0000	2.5000	1	456		
GRID	8152	1	1.0000	56.0000	3.0000	1	456		
GRID	8153	1	1.2500	56.0000	3.0000	1	456		
GRID	8154	1	1.5000	56.0000	3.0000	1	456		
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GRID	8156	1	2.0000	56.0000	3.0000	1	456		
GRID	8177	1	1.0000	56.0000	3.5000	1	456		
GRID	8178	1	1.2500	56.0000	3.5000	1	456		
GRID	8179	1	1.5000	56.0000	3.5000	1	456		
GRID	8180	1	1.7500	56.0000	3.5000	1	456		
GRID	8181	1	2.0000	56.0000	3.5000	1	456		
GRID	8202	1	1.0000	56.0000	4.0000	1	3456		
GRID	8203	1	1.2500	56.0000	4.0000	1	456		
GRID	8204	1	1.5000	56.0000	4.0000	1	456		
GRID	8205	1	1.7500	56.0000	4.0000	1	456		
GRID	8206	1	2.0000	56.0000	4.0000	1	456		
CHEXA	6001	1	6002	6003	8003	8002	6027	6028CBC	
6001	+BC 6001	8028	8027						
	CHEXA	6002	1	6003	6004	8004	8003	6028	6029CBC
6002	+BC 6002	8029	8028						
	CHEXA	6003	1	6004	6005	8005	8004	6029	6030CBC
6003	+BC 6003	8030	8029						
	CHEXA	6004	1	6005	6006	8006	8005	6030	6031CBC
6004	+BC 6004	8031	8030						
	CHEXA	6005	1	6027	6028	8028	8027	6052	6053CBC
6005	+BC 6005	8053	8052						
	CHEXA	6006	1	6028	6029	8029	8028	6053	6054CBC
6006	+BC 6006	8054	8053						
	CHEXA	6007	1	6029	6030	8030	8029	6054	6055CBC
6007	+BC 6007	8055	8054						
	CHEXA	6008	1	6030	6031	8031	8030	6055	6056CBC
6008	+BC 6008	8056	8055						
	CHEXA	6009	1	6052	6053	8053	8052	6077	6078CBC
6009	+BC 6009	8078	8077						
	CHEXA	6010	1	6053	6054	8054	8053	6078	6079CBC
6010	+BC 6010	8079	8078						
	CHEXA	6011	1	6054	6055	8055	8054	6079	6080CBC
6011	+BC 6011	8080	8079						
	CHEXA	6012	1	6055	6056	8056	8055	6080	6081CBC
6012	+BC 6012	8081	8080						
	CHEXA	6013	1	6077	6078	8078	8077	6102	6103CBC
6013	+BC 6013	8103	8102						
	CHEXA	6014	1	6078	6079	8079	8078	6103	6104CBC
6014									

6015	+BC 6014 CHEXA	8104 6015	8103 1	6079	6080	8080	8079	6104	6105CBC
6016	+BC 6015 CHEXA	8105 6016	8104 1	6080	6081	8081	8080	6105	6106CBC
6017	+BC 6016 CHEXA	8106 6017	8105 1	6102	6103	8103	8102	6127	6128CBC
6018	+BC 6017 CHEXA	8128 6018	8127 1	6103	6104	8104	8103	6128	6129CBC
6019	+BC 6018 CHEXA	8129 6019	8128 1	6104	6105	8105	8104	6129	6130CBC
6020	+BC 6019 CHEXA	8130 6020	8129 1	6105	6106	8106	8105	6130	6131CBC
6021	+BC 6020 CHEXA	8131 6021	8130 1	6127	6128	8128	8127	6152	6153CBC
6022	+BC 6021 CHEXA	8153 6022	8152 1	6128	6129	8129	8128	6153	6154CBC
6023	+BC 6022 CHEXA	8154 6023	8153 1	6129	6130	8130	8129	6154	6155CBC
6024	+BC 6023 CHEXA	8155 6024	8154 1	6130	6131	8131	8130	6155	6156CBC
6025	+BC 6024 CHEXA	8156 6025	8155 1	6152	6153	8153	8152	6177	6178CBC
6026	+BC 6025 CHEXA	8178 6026	8177 1	6153	6154	8154	8153	6178	6179CBC
6027	+BC 6026 CHEXA	8179 6027	8178 1	6154	6155	8155	8154	6179	6180CBC
6028	+BC 6027 CHEXA	8180 6028	8179 1	6155	6156	8156	8155	6180	6181CBC
6029	+BC 6028 CHEXA	8181 6029	8180 1	6177	6178	8178	8177	6202	6203CBC
6030	+BC 6029 CHEXA	8203 6030	8202 1	6178	6179	8179	8178	6203	6204CBC
6031	+BC 6030 CHEXA	8204 6031	8203 1	6179	6180	8180	8179	6204	6205CBC
6032	+BC 6031 CHEXA	8205 6032	8204 1	6180	6181	8181	8180	6205	6206CBC
	+BC 6032	8206	8205						
	FLOAD	130000.00		6002	6003	8003	8002		
	FLOAD	130000.00		6003	6004	8004	8003		
	FLOAD	130000.00		6004	6005	8005	8004		
	FLOAD	130000.00		6005	6006	8006	8005		
	FLOAD	130000.00		6006	6031	8031	8006		

	PLOAD	130000.00	6031	6056	8056	8031		
	PLOAD	130000.00	6056	6081	8081	8056		
	GRID	10002	1	1.0000	78.0000	0.0000	1	456
	GRID	10027	1	1.0000	78.0000	.5000	1	456
	GRID	10052	1	1.0000	78.0000	1.0000	1	456
	CHEXA	8001	1	8002	8003	10003	10002	8027
8001								8028CBC
	+BC 8001	10028	10027					
	CHEXA	8002	1	8003	8004	10004	10003	8028
8002								8029CBC
	+BC 8002	10029	10028					
	CHEXA	8003	1	8004	8005	10005	10004	8029
8003								8030CBC
	+BC 8003	10030	10029					
	CHEXA	8004	1	8005	8006	10006	10005	8030
8004								8031CBC
	+BC 8004	10031	10030					
	CHEXA	8005	1	8027	8028	10028	10027	8052
8005								8053CBC
	+BC 8005	10053	10052					
	CHEXA	8006	1	8028	8029	10029	10028	8053
8006								8054CBC
	+BC 8006	10054	10053					
	CHEXA	8007	1	8029	8030	10030	10029	8054
8007								8055CBC
	+BC 8007	10055	10054					
	CHEXA	8008	1	8030	8031	10031	10030	8055
8008								8056CBC
	+BC 8008	10056	10055					
	CHEXA	8009	1	8052	8053	10053	10052	8077
8009								8078CBC
	+BC 8009	10078	10077					
	CHEXA	8010	1	8053	8054	10054	10053	8078
8010								8079CBC
	+BC 8010	10079	10078					
	CHEXA	8011	1	8054	8055	10055	10054	8079
8011								8080CBC
	+BC 8011	10080	10079					
	CHEXA	8012	1	8055	8056	10056	10055	8080
8012								8081CBC
	+BC 8012	10081	10080					
	CHEXA	8013	1	8077	8078	10078	10077	8102
8013								8103CBC
	+BC 8013	10103	10102					
	CHEXA	8014	1	8078	8079	10079	10078	8103
8014								8104CBC
	+BC 8014	10104	10103					
	CHEXA	8015	1	8079	8080	10080	10079	8104
8015								8105CBC
	+BC 8015	10105	10104					
	CHEXA	8016	1	8080	8081	10081	10080	8105
8016								8106CBC
	+BC 8016	10106	10105					
	CHEXA	8017	1	8102	8103	10103	10102	8127
8017								8128CBC
	+BC 8017	10128	10127					
	CHEXA	8018	1	8103	8104	10104	10103	8128
8018								8129CBC
	+BC 8018	10129	10128					
	CHEXA	8019	1	8104	8105	10105	10104	8129
								8130CBC

8019	+BC 8019	10130	10129						
	CHEXA	8020	1	8105	8106	10106	10105	8130	8131CBC
8020	+BC 8020	10131	10130						
	CHEXA	8021	1	8127	8128	10128	10127	8152	8153CBC
8021	+BC 8021	10153	10152						
	CHEXA	8022	1	8128	8129	10129	10128	8153	8154CBC
8022	+BC 8022	10154	10153						
	CHEXA	8023	1	8129	8130	10130	10129	8154	8155CBC
8023	+BC 8023	10155	10154						
	CHEXA	8024	1	8130	8131	10131	10130	8155	8156CBC
8024	+BC 8024	10156	10155						
	CHEXA	8025	1	8152	8153	10153	10152	8177	8178CBC
8025	+BC 8025	10178	10177						
	CHEXA	8026	1	8153	8154	10154	10153	8178	8179CBC
8026	+BC 8026	10179	10178						
	CHEXA	8027	1	8154	8155	10155	10154	8179	8180CBC
8027	+BC 8027	10180	10179						
	CHEXA	8028	1	8155	8156	10156	10155	8180	8181CBC
8028	+BC 8028	10181	10180						
	CHEXA	8029	1	8177	8178	10178	10177	8202	8203CBC
8029	+BC 8029	10203	10202						
	CHEXA	8030	1	8178	8179	10179	10178	8203	8204CBC
8030	+BC 8030	10204	10203						
	CHEXA	8031	1	8179	8180	10180	10179	8204	8205CBC
8031	+BC 8031	10205	10204						
	CHEXA	8032	1	8180	8181	10181	10180	8205	8206CBC
8032	+BC 8032	10206	10205						
	PLOAD	130000.00		8002	8003	10003	10002		
	PLOAD	130000.00		8003	8004	10004	10003		
	PLOAD	130000.00		8004	8005	10005	10004		
	PLOAD	130000.00		8005	8006	10006	10005		
	PLOAD	130000.00		8006	8031	10031	10006		
	PLOAD	130000.00		8031	8056	10056	10031		
	PLOAD	130000.00		8056	8081	10081	10056		
	MAT1	1	.10E+08	.38E+07	.32E+00	.10E+00			
	CORD1C	1	101	102	103				
	GRID	101		0.0	0.0	0.0		123456	
	GRID	102		0.0	0.0	1.0		123456	
	GRID	103		1.0	0.0	1.0		123456	
	GRAV	2	1	.76E+05	0.0	0.0	-1.0		
	PSOLID	1	1	1					
	ENDDATA								

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